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A review of the Rhinophoridae (Diptera), and a revision of the Afrotropical species

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Contents

Synopsis

The paper provides the first comprehensive account of Afrotropical Rhinophoridae, of which 10 genera and 23 species are recognized, described and keyed (including four new genera and 13 new species). The Rhinophoridae are characterized on a world basis, and the family status and generic classification of the group discussed. The small Oriental fauna is briefly reviewed and keyed. It is emphasized that there are no Afrotropical host records but that elsewhere the rhinophorids are of great biological interest because of their unique habit of parasitizing terrestrial isopods (woodlice). The taxonomic treatment includes five new generic synonyms, one new specific synonym and six new combinations.

Introduction

The family Rhinophoridae is a taxonomic waif, neglected by professional and amateur dipterists alike. This is a pity, because despite the unexciting appearance of the adult flies the family is potentially of great biological interest as it appears to contain the only Diptera known to parasitize Crustacea.* Thompson (1934), in a paper that is a classic of diptero-parasitology, definitively

* But commensal and phoretic relationships between Diptera and Crustacea are well known, such as those between some African simuliids and river-crabs and prawns; and the unexplained but probably accidental occurrence of ephydrid-like larvae in the branchial chambers of land-crabs has been reported (Keilin, 1921).

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established that several European species of rhinophorids are parasites of woodlice (terrestrial Isopoda), and his observations have been confirmed from time to time by later authors. But only Bedding (1973), who describes the first instar larvae of some British species and their adaptations for host penetration, has added significantly to the foundation of biological knowledge laid by Thompson.

Knowledge of early stages, however, is still too inchoate to be utilized for classification, and the taxonomy of rhinophorids is still wholly dependent on the characters of adult flies. Even so, there are extremely few taxonomic works of recent years that are in any way comprehensive and all are concerned with the European fauna – because most rhinophorids are (or at least have been thought to be) Palaearctic. Most useful are Séguy's (1941) account of the western and southern European fauna, van Emden's (1954) treatment of the British species, and Herting's (1961) monograph of Palaearctic forms. The last-named work is a useful introduction to classification but is unillustrated.

For the Afrotropical Region (a term preferred to Ethiopian Region for the reasons given by Crosskey & White, in press) taxonomic information has been exceedingly scanty, and there has been no previous attempt to synthesize such information as does exist or to describe the various new taxa that are to be found scattered in collections. In offering the present work I make it clear that its genesis lies not in any longstanding acquaintance with the group, but in the purely practical need to produce an account of the fauna (describing the various new genera and species) in advance of the new catalogue of Afrotropical Diptera currently in production by this Museum. The paper has been hastily produced and in some respects falls short of the fullest revisionary standards (for instance I have not attempted to study and illustrate the male genitalia of all species and have not therefore derived all the taxonomic information possible from these structures); but it is hoped that its prime objects of providing means of identification and tolerably adequate descriptions of new taxa have been attained.

Nothing, it should be added, is known of the biology of Afrotropical species and it is by inference that it is assumed that they parasitize the rich African woodlouse fauna. In the interests of convenience I coin the vernacular term 'woodlouse-flies' for members of the Rhinophoridae.

Material and methods

This work is based primarily on a study of rhinophorid material in the collection of the British Museum (Natural History), but types and such small quantities of previously undetermined Afrotropical material as existed in other collections have been studied also. The following list shows the abbreviations used for the repositories of material seen.

AMNH	American Museum of Natural History, New York
BMNH	British Museum (Natural History), London
IRSNB	Institut Royal des Sciences Naturelles de Belgique, Brussels
MNHN	Muséum National d'Histoire Naturelle, Paris
MNHU	Museum für Naturkunde der Humboldt-Universität, Berlin
MRAC	Musée royal de l'Afrique centrale, Tervuren
NM	Naturhistorisches Museum, Vienna
NMP	Natal Museum, Pietermaritzburg
SAM	South African Museum, Cape Town
USNM	United States National Museum, Washington, D.C.
UZI	Universitetets Zoologiska Institution, Lund

Most of the terminology used in this work is shown in Figs 1–7, and comment is needed only on a few terms not covered by illustration and on the abbreviations used.

The side of the thorax is not illustrated but standard terms such as propleuron, and sternopleural, hypopleural and pteropleural setae are assumed to be familiar. Less familiar terms for lateral thoracic features are as follows: *pleurotergite* is the sclerite above the metathoracic spiracle and behind the pteropleuron (i.e. the supraspiracular convexity of Zumpt); *mediotergite* is the broad posterodorsal declivity of the thorax below the postscutellum and lower calyptrae; *infra-*

squamal hairs are minute hairs on each side of the mediotergite close to the bases of the lower calyptrae; *barette* is the small subrectangular area between pteropleuron and hypopleuron.

Positions of leg setae are indicated by the convention of imagining the leg to be extended at right-angles to the long axis of the fly, when setae can be:

a	anterior	*p*	posterior
ad	anterodorsal	*pd*	posterodorsal
av	anteroventral	*pv*	posteroventral
d	dorsal	*v*	ventral

It is important to note that *tibial setae described by any of these letters are on the shaft of the tibia and not at its end unless otherwise specified.*

Names of thoracic setae are abbreviated as follows:

acr	acrostichal	*pra*	pre-alar
dc	dorsocentral	*stpl*	sternopleural
ia	intra-alar		

When it is necessary to show whether the *acr*, *dc* or *ia* setae are in front of or behind the transverse suture (i.e. the depression separating prescutum from scutum) these abbreviations are prefixed *prst* (presutural) and *post* (postsutural) respectively. Thus *prst acr* indicates presutural acrostichal setae.

Abdominal tergites are indicated by the letter T followed by the relevant segment number. The first apparent tergite is T1+2 and the last large tergite visible from above is T5: the two intervening tergites (T3 and T4) are sometimes referred to jointly as 'intermediate abdominal tergites'.

In the wing venation cell R_5 is described as 'petiolate' if closed well before the wing edge by coalescence of veins M and R_{4+5} and connected with the wing apically by a 'petiole' of the kind shown in Fig. 18.

Setae bending forwards and downwards in relation to the surface on which they stand are 'proclinate' and those that bend upwards and backwards are 'reclinate'. The ultramicroscopic pubescence that accounts for so much of the pattern and general appearance is termed 'pollinosity' (dusting of some authors), and a surface bearing it is termed 'pollinose' if the pollinosity is obvious to the naked eye or at low-power microscope examination.

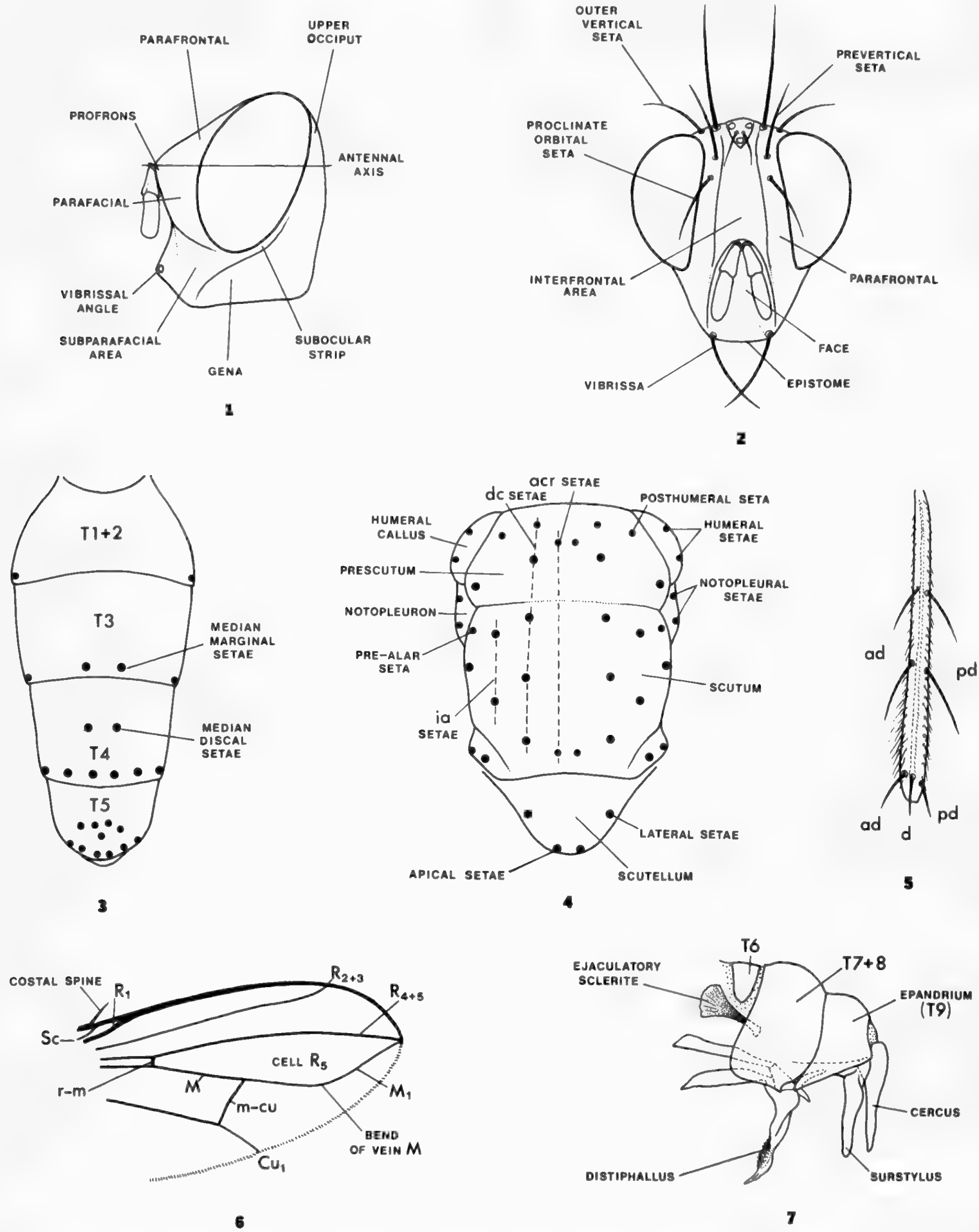
Finally it may be mentioned that a glossary of terms used in taxonomy of Tachinidae that is fully relevant also to Rhinophoridae has recently been published (Crosskey, 1973).

Family status and recognition

It is to Villeneuve (1924) that we owe the current taxonomic concept of the rhinophorids, for he was the first dipterist to define this suprageneric group of muscoid flies in anything like its modern sense (although there had been earlier usages of a restricted subfamily Rhinophorinae). For some fifty years now dipterists who have touched the rhinophorids have – in essence at least, and give or take a genus or two – been following Villeneuve's ideas. But there has, nevertheless, been much less agreement on how to rank the group and where to place it in relation to other calyptrate flies, though authors have been at one in placing the rhinophorids very close to the tachinids, calliphorids and sarcophagids and in regarding the exact relationships as problematical. Villeneuve ranked the group as a subfamily of Tachinidae, but used the latter name for an all-embracing muscoid family that included all the forms now regarded as composing the Calliphoridae and Sarcophagidae as well as the true Tachinidae; Villeneuve thus equated Rhinophorinae with the other subfamilies that comprised Tachinidae in his wide sense, such as Tachininae, Dexiinae, Phasiinae, Calliphorinae and Sarcophaginae (in effect giving the rhinophorines equivalent ranking to calliphorines and sarcophagines, so that if each of these were to be regarded as a family then the rhinophorines should be also).

Villeneuve's (1924) system, under which virtually all the muscoids with hypopleural setae were 'Tachinidae' and all those without were 'Anthomyidae', did not survive long in this form, and

was soon almost universally supplanted by a system in which the forms with hypopleural setae were regarded as forming two (or more) families – the most commonly accepted system (and that still favoured by some dipterists) being one in which forms with hypopleural setae and a swollen postscutellum formed the Tachinidae proper and forms with hypopleural setae but



Figs 1–7 Terminology used in the text. (1) head, lateral view. (2) head, facial view. (3) abdomen, dorsal view. (4) thorax, dorsal view. (5) hind tibia, left side and dorsal view. (6) wing. (7) ♂ postabdomen, lateral view. Setae omitted from Fig. 1 and their positions indicated by black dots on Figs 3 and 4.

without a convexly swollen postscutellum formed the Calliphoridae. This is the system that was adopted, for instance, by Séguy (1941) and van Emden (1954) and that is still favoured by Zumpt (various publications). In many respects it is a sound taxonomic system, for while it can result in some anomalies that few dipterists would now approve (e.g. van Emden's inclusion of the oestroids in the phasiine Tachinidae) it does in general reflect a fundamental biological cleavage – the true Tachinidae being parasites of other insects and adapted accordingly, and the Calliphoridae, though having very varied biology, being mainly non-parasitic (although including some parasites of insects in the miltogrammine–sarcophagine line). (From the nomenclatural viewpoint, however, the Calliphoridae versus Tachinidae system is wrong, since dipterists have overlooked the fact that several family-group names have priority over Calliphoridae, for example Rhinophoridae itself dates back to 1863.)

The fitting of the rhinophorids into the two-family Tachinidae–Calliphoridae system by past authors has given rise to some discrepancies in treatment that more or less persist to the present time. The majority view has been that the woodlouse-flies should be included as a subfamily within the Calliphoridae, a view held, for example by Mesnil (1939), Séguy (1941), Hennig (1952), van Emden (1954), Zumpt (1956*a*; 1956*b*) and Herting (1957; 1961), but a few modern authors have placed them as a subfamily of Tachinidae (Sabrosky & Arnaud (1965) and Guimarães (1971), for instance, have done this but from the viewpoint of cataloguing rather than any detailed appraisal of affinities). The most recent trend, however, is to regard the woodlouse-flies as forming a small discrete family (Rhinophoridae) equivalent in rank to the Calliphoridae, Sarcophagidae and Tachinidae, this system being adopted, for instance, by Brues *et al.* (1954), Verbeke (1962), Rohdendorf (1964), Lehrer (1966) and Hennig (1973).

The ranking of supraspecific taxa cannot be objectively determined, at least by the methods of classical evolutionary taxonomy, and clearly arguments can be adduced to defend the ranking of a particular taxon only in the most subjective way. Nevertheless, I favour the view now gaining ground that the woodlouse-flies are best ranked as a full family of calyptrate flies, and the object of this section is to put forward the reasons for this view and to show how the group can be recognized and distinguished from other families of related muscoid Diptera. The arguments are confined to comparison with tachinids, calliphorids and sarcophagids (including miltogrammines) as dipterists do not dispute that these are the closest affines of the rhinophorids. (Townsend's (1935; 1938) idiosyncratic system under which the rhinophorid genera were distributed among three tribes of Melanophoridae is left out of consideration, as it cannot be equated with any modern system and no present-day dipterist takes Townsend's muscoid family classification seriously (see Townsend's *Manual of Myiology*).)

In brief, and before discussing the significant points in detail, the reasons for accepting the rhinophorids as a family may be stated thus:

(1) the group contains the only Diptera that parasitize woodlice (Crustacea : Isopoda) and is confined, or nearly so, to this group of hosts (at least, so far as present knowledge goes);

(2) the reproductive habit and first-stage larval morphology are distinctive, and taken together unique, among the muscoid flies;

(3) the adult morphology is homogeneous (excluding certain aberrant forms that may not belong) but shows characters that preclude unambiguous assignment to any one of the neighbouring families;

[Arbitrary retention of rhinophorids within Calliphoridae or Sarcophagidae or Tachinidae serves only to increase the heterogeneity of whichever family is selected as 'parent' and to make it less discretely definable.]

(4) it obviates the practical nomenclatural difficulty (persistently and unjustifiably ignored by dipterists) that the name Rhinophoridae has priority over Calliphoridae.

[Strictly, under the rules of nomenclature, the whole broad resultant family should be known as Rhinophoridae if the group is included within 'Calliphoridae' or 'Sarcophagidae'. Tachinidae as a name pre-dates Rhinophoridae and is not affected.]

With regard to the discussion that follows it must be emphasized that eggs, larvae and hosts are only known for a small proportion of species, and that it has been necessary to extrapolate assumptions from these for the family as a whole. In the discussion of adult features the aberrant

genus *Bequaertiana* Curran, which may not belong, is ignored (its early stages and hosts, if indeed parasitic, are unknown).

Early stages and host relations

The first-stage larvae of Rhinophoridae are very distinctive, with specialized adaptations involved in securing a hold upon, or gaining entry through, the body-wall of the woodlouse host. A glance at Bedding's (1973) figures shows convincingly that first-stage larvae are very unlike the relatively featureless subcylindrical or fusiform first-stage maggots that are characteristic of most calliphorids, sarcophagids or tachinids. Bedding differentiates two kinds of rhinophorid first-stage larva, one in which the body segments bear complex pseudopod-like processes and another that lacks such fleshy projections but that has the posterior end modified into a complicated pad-like structure on which the larva can swivel in an erect posture. Apart from these unusual features, the larvae show a strangely warty surface combined with various arrangements of spines or strongly sclerotized scales (*Stevenia atramentaria* larva even having a long furcate process on the last segment for interlocking with the brood-pouch of the host). In addition to these external morphological features the first-stage rhinophorid larvae show some unusual modifications in the buccopharyngeal skeleton, the paired mandibular sclerites being short and deep and having two or more teeth on each, and the anterior section of the pharyngeal sclerite being extraordinarily slender and elongate. Modifications of this kind do not seem to occur, so far as I can judge from the literature, in any related groups of muscoid flies, even among Tachinidae (a family in which specialized modifications of the first-stage larva – such as its conversion to a perfect planidium – are prone to crop up).

Most commonly the first-stage larva of calliphorids, sarcophagids and tachinids is a simple maggot showing little external modification except for segmental bands of micro-spines, quite unlike the rhinophorid larva, and this holds true even for the parasitic members of the Calliphoridae and Sarcophagidae (families that are mainly non-parasitic). No members of the Calliphoridae s. str. have insect hosts, but the few that are parasitic on other invertebrates, such as the species of *Pollenia* Robineau-Desvoidy and *Onesia* Robineau-Desvoidy attacking earthworms (Keilin, 1915; Fuller, 1933) and of *Melinda* Robineau-Desvoidy parasitizing molluscs (Keilin, 1919), have rather simple musciform first-stage larvae without any of the external modifications found in rhinophorids. The same appears to be true of the first-stage larvae of parasitic Sarcophagidae (including the miltogrammines) (Thompson, 1921; Knipling, 1936). Thus it appears impossible to find any real equivalent to the rhinophorid first-stage larva even in those parasitic forms of allied groups having hosts that, seemingly, might pose similar problems in host-penetration.

Another biological aspect making the Rhinophoridae curious among parasitic forms is the fact that the highly specialized first-stage larvae are associated with an oviposition habit of great simplicity and apparent primitiveness. Rhinophorids, so far as is known, are oviparous and deposit the eggs freely away from the host. But while this in itself is not unusual in parasitic muscoids, the rhinophorids are extraordinary because they deposit soft-shelled, flexible and unincubated eggs that require to develop for several days before the larvae are ready to hatch. This habit contrasts strongly with the Tachinidae, in which (if deposition does not occur as larvae) the eggs are already fully incubated when they are laid and the embryo larvae ready for immediate emergence.

Thus the rhinophorids appear to have a uniquely distinctive biology, combining the parasitic habit on an unusual host-group with highly modified first-instar larvae emerging from eggs that incubate outside of the mother flies. Nothing quite comparable to this seems to occur in tachinids, sarcophagids and calliphorids and the biology therefore offers considerable support for according family rank to the group.

It need only be added here that egg morphology, second-stage and third-stage larvae (and therefore puparia) show no specially distinctive characters in rhinophorids that assist in determining the exact relationships, as indeed is most generally the case in the whole calliphorid–sarcophagid–rhinophorid–tachinid complex. It is noteworthy, however, that the older larvae of rhinophorids and the puparia do not have deeply sunken hind spiracles of the kind that occur in

Sarcophaginae, the posterior spiracles being borne instead very prominently and sometimes on a narrowed terminal extension of the body (Thompson, 1934).

Adult morphology

In practice the differentiation of the Rhinophoridae from the allied families (Tachinidae, Calliphoridae, Sarcophagidae) is dependent on morphological characters of the imagines, and this section is aimed at calling attention to the principal adult characters that jointly or severally support the family ranking for Rhinophoridae and at the same time assist in family recognition.

Before enumerating the essential characters, however, some comment is needed on the general problem of satisfactory differentiation of the families cited above. Most family keys existing in the literature deal with a limited geographical fauna, such as that of Britain or of one zoogeographical region, and the characters used serve more or less satisfactorily for the placement of a specimen into its rightful family or subfamily. On a world basis, though, it is a much less straightforward matter to provide simple workable keys that will unambiguously place a specimen into its correct family, because among the thousands of species comprising the vast Tachinidae–Calliphoridae–Sarcophagidae–Rhinophoridae complex are many that are highly aberrant or that show confusing mosaics of characters making them hard to fit into a particular family. The Australian fauna, for example, includes many odd and undescribed calyptrate flies for which the proper family placement is very obscure (though many will probably prove to be tachinids when their biology becomes known, despite the lack of a convexly swollen postscutellum).

The swollen postscutellum of Tachinidae is a good instance of the 'classic' key character cited over and over again as diagnostic for the family, when in fact there are many tachinids in which postscutellar swelling is absent or insignificant. Hennig (1973 : 14), for instance, uses it in the most recent comprehensive key to dipterous families. Of course, it is an extremely useful character as it is a feature of at least 95 per cent of described tachinid species. But the point is that swelling of the postscutellum is not nearly so reliable a character for recognition of the Tachinidae as the standard keys would make it appear, and many forms that are undoubtedly tachinids on all the evidence would be run down to some other family simply because they lack any pronounced swelling of the postscutellar region.

Throughout the enormous complex under discussion, but most notably in Tachinidae, there occur species showing features that obscure their real relationships and that defeat all attempts to key, and to characterize, the different families or other suprageneric taxa on just one or a small number of characters (however judiciously chosen). In Tachinidae there are even a few species (such as *Lophosiosoma bicornis* Mesnil) in which hypopleural setae are totally wanting, although presence of these setae is supposedly diagnostic for the Tachinidae–Calliphoridae–Sarcophagidae–Rhinophoridae complex (in contrast to the Muscidae and allied families in which hypopleurals are absent). Likewise there are many Tachinidae in which the mouthparts are almost completely vestigial, such forms being so like oestroids in this respect that they do not run down to Tachinidae in standard keys (e.g. that run to Gasterophilidae and Oestridae in Hennig's *op. cit.* key).

In the circumstances outlined above it cannot be expected that the Rhinophoridae can be immediately distinguished from other families by some simple character or small suite of characters, and Hennig (1973 : 14) made no attempt in his key to world Diptera families to differentiate the Calliphoridae, Sarcophagidae, Rhinophoridae and Stackelbergomyiidae from each other, even though he accepted family status for each (Hennig simply remarking 'Sichere diagnostische Merkmale zur Unterscheidung der Familien, deren Umgrenzung zum Teil auch noch unglekärt ist, können nicht angegeben werden'). In dealing here with the Rhinophoridae, however, I feel that an attempt is needed at a 'recognition couplet' that will enable the family to be differentiated reasonably concisely from the other families with which its members could be confused. The recognition couplet given below embraces the features that, taken collectively, should ensure accurate family identification for *almost* all specimens (*even with this extended set of characters there remain a very few aberrant tachinids that will more or less fit the rhinophorid characterization*).

Metathoracic spiracles with erect fringes around the openings (Figs 41–44). Postscutellum not convexly swollen or only very slightly so. Lower calpytrae small and subcircular or slightly tongue-like,

widely removed from scutellum.* Propleura, prosternum, sub-alar bullae, postalar walls, pleurotergites and suprasquamal ridges bare. 2+3 dorsocentral setae. Abdominal T1+2 not excavate. ♂ abdominal sternites exposed or mainly so. Wing without M_2 appendix or fold extending from bend of M and with M_1 almost straight whatever its direction (i.e. not inflexed). Stem-vein bare. ♂ postabdomen with well-developed sixth tergite. Hind tibia with *ad*, *d* and *pd* preapical setae. Facial carina absent. Facial ridges without strong setae (at most with weak vestiture near vibrissae). Eyes bare **RHINOPHORIDAE**

Forms without this combination of characters present simultaneously and almost always with a distinct operculum to the metathoracic spiracle (e.g. Figs 45, 46) **CALLIPHORIDAE, SARCOPHAGIDAE, TACHINIDAE**

* Except widened in one species.

The following comments indicate how some of the rhinophorid characters cited in the foregoing couplet have particular value in distinguishing the family.

Metathoracic spiracles

In Calliphoridae, Sarcophagidae and the great majority of Tachinidae the external opening of the metathoracic spiracle is occluded by one or a pair of complex shutters (the 'volets' of Séguy), one of which when they are paired acts as a movable flap or operculum. In Rhinophoridae, however, the external opening of the spiracle lacks a definite occluding flap or pair of flaps and instead is margined by complex short fringes that stand out from the spiracular rim (there being normally an anterior and a posterior fringe that meet ventrally but that are widely separated dorsally). The nature of the metathoracic spiracle provides the most important single character for rhinophorid recognition, and has been used by various authors in keys to the groups here discussed. Séguy (1941) and van Emden (1954), for instance, used it as a differentiating character between Rhinophorinae and Sarcophaginae. The character can easily be used in practice at low magnification, but it is difficult with the conventional entomological microscope to discern the exact structure of the spiracular fringes and very difficult to draw the spiracle satisfactorily: Séguy's (1941 : 333) drawing, though a brave attempt, is not very accurate. I am therefore including in the present paper some photographs of the rhinophorid metathoracic spiracle taken with the BMNH stereoscan microscope so that the exact conformation of the spiracular fringes can be clearly understood. Figs 41–44 shows the spiracle in four well-distinct genera of Palaearctic rhinophorids (Fig. 41, *Rhinophora lepida*; Fig. 42, *Phyto discrepans*; Fig. 43, *Stevenia atramentaria*; Fig. 44, *Melanophora roralis*). The photographs show the spiracle of the left side with approximately similar orientation (it is difficult to ensure *exactly* similar orientation) and convey very clearly the fringe morphology and the break in the fringing on the upper spiracular margin. (The photographs also hint that fringe morphology might differ significantly between genera, but it has been outside the scope of the work to pursue this.)

For comparison, stereoscan photographs are included that show the spiracle of the 'occluding operculum' type, Fig. 45 being that of a tachinid (*Peribaea orbata* (Wiedemann)) and Fig. 46 that of a calliphorid (*Phumosia lutescens* (Villeneuve)). A wide range of 'opercular' metathoracic spiracles occurs in Tachinidae–Calliphoridae–Sarcophagidae but the two shown in Figs 45 and 46 are representative of two very common types.

Unfortunately the subcircular 'fringed' spiracle of the rhinophorid type is not entirely confined to the family, and the same kind of spiracle is found here and there in the Tachinidae (e.g. in *Archiphania* Emden, *Litophasia* Girschner, *Bezzimyia* Townsend). On the other hand, the opercular type of spiracle does not occur in any rhinophorid. *Termitoloemus* Baranov (which might not be a rhinophorid) is exceptional in having the fringe replaced by a series of long strong hairs or fine setulae subcircularly arranged around the spiracular opening, and *Bequaertiana* Curran (also possibly not a rhinophorid) is extraordinary in having the metathoracic spiracle in the form of a simple large hole without any protective fringe or operculum (much as in the tachinid genus *Cinochira* Zetterstedt).

The subcircular shape of the rhinophorid hind spiracle is itself a characteristic and helpful recognition feature, as in the overwhelming majority of forms in the other families the spiracle

is distinctly elongate (e.g. as in Fig. 46). A practical instance illustrates this: the unusually small black calliphorid *Phumosia currani* Zumpt & Stimie looks very rhinophorid-like on first examination, but the conspicuously elongate metathoracic spiracle shows that Rhinophoridae would be an erroneous family identification.

Lower calyptrae

These structures, the thoracic squamae of some authors, provide a very important recognition feature. They are unusually small and rounded, and Séguy (1941), van Emden (1954) and others have used them to differentiate rhinophorines from sarcophagines. They certainly provide one of the best differential characters between Rhinophoridae and Sarcophagidae–Calliphoridae (as both these families contain, with very few exceptions, forms that have broad calyptrae with rather straight hind margins) but are less exclusively useful in differentiation from Tachinidae (as small subcircular calyptrae occur in several groups of tachinids, notably in Minthoini and Palpostomatini).

Wing venation

This is of no help in reliable differentiation from Tachinidae, as this family shows the same range of venational variability, but provides helpful adjuncts to other characters for distinguishing rhinophorids from sarcophagids (including miltogrammines). In Sarcophagidae the apical part of the median vein, that is to say the section M_1 that runs from the bend of M to the wing edge, is inwardly flexed (M_1 usually springing from the 'bend' at about a right-angle and then curving again towards the wing apex so as to describe an inwardly convex arc), and there is most often a faint M_2 appendix or fold in the wing membrane extending straight from the bend. In Rhinophoridae two main types of venation occur, one in which the bend is extremely sharp and cell R_5 very long-petiolate (Figs 25, 26) and another in which the bend is widely obtuse (Figs 19–24), but both kinds of venation differ conspicuously from that found in Sarcophagidae because M_1 is straight or nearly so and an M_2 appendix or fold is absent. Occasionally the rhinophorid M_1 is slightly inwardly convex towards the apex (e.g. Fig. 21), but it never shows the sudden flexure near the bend that is characteristic of Sarcophagidae (and that is well shown by the series of illustrations of sarcophagine and miltogrammine wings in Séguy's (1941) account of the European fauna).

As an aid to the separation of certain aberrant rhinophorid-like Tachinidae from true rhinophorids it is important to note that when a long-petiolate cell R_5 occurs in Rhinophoridae it is always associated with extremely abrupt angulation of the bend of M. There are no instances of long-petiolate rhinophorid wings simultaneously showing the very open and evenly curved bend of M such as occurs in many of the genera of phasiine Tachinidae. This makes it possible to recognize certain aberrant Phasiinae in which the postscutellum is undeveloped (e.g. the genus *Litophasia*) as being true tachinids, despite their rhinophorid-like appearance.

Bare thoracic surfaces

In the Rhinophoridae the prosternum, propleura, pleurotergites, sub-alar bullae, postalar walls, supra-squamal ridges and stem-veins of the wings are all bare, and this correlation of bare surfaces is extremely helpful in reliable recognition of the family, and especially in differentiation from members of the Calliphoridae. Rhinophorids could not, of course, be confused with such groups as Ameniinae (that have the postalar walls haired), Rhiniinae (that have the stem-veins haired), Mesembrinellinae (that have the prosternum haired and an enormous metathoracic spiracle), or with such genera as *Chrysomya* Robineau-Desvoidy (sub-alar bulla haired) and *Lucilia* Robineau-Desvoidy (suprasquamal ridges haired), but in the Calliphorinae a number of forms occur that, superficially at least, could be taken to be rhinophorids. In these cases possession of hairing on one of the surfaces specified above is sufficient to contra-indicate Rhinophoridae as the correct family placement. For example, the small black calliphorine *Phumosia currani* already mentioned above in relation to the posterior spiracle is rather like a rhinophorid but has the pleurotergites long-haired, and the Australian calliphorine genus *Aphyssura* Hardy might be mistaken for a rhinophorid but has the propleura haired; in both cases elimination from the possibility of

belonging to Rhinophoridae can safely be done on the presence of hairing on particular thoracic sclerites (the elimination being confirmed by other attributes). One last instance involving recognition on this basis may be mentioned. The BMNH collection contains specimens of an apparently undescribed species of the calliphorine genus *Adichosina* Villeneuve which is unusually slender for a calliphorid and might be considered a candidate for Rhinophoridae: hairing on the prosternum, however, makes this unlikely and elimination from Rhinophoridae is confirmed by the large operculate metathoracic spiracle (though the very small subcircular lower calyptrae of the species are exceedingly rhinophorid).

Head and antennal features

Rather few cephalic characters assist in family recognition, but it is noteworthy that no rhinophorids have a long series of setae or setulae up the whole height of the facial ridges as occurs in many Tachinidae. This helps to differentiate certain aberrant Tachinidae with reduced postscutellum and fringed instead of operculate metathoracic spiracles, e.g. *Bezzimyia*, from Rhinophoridae. Also no rhinophorids have a facial carina (cf. Ameniinae and many imitomyiine and prosenine Tachinidae in which a strong carina separating the antennae occurs).

In both sexes of all known Rhinophoridae the antennae are simple and parallel-sided, though sometimes very small. There are no instances of strong dilation of the third antennal segment, nor of bifurcation or fissicorn development of male antennae such as are found in various groups of Tachinidae. Hence any aberrant specimen that might be a rhinophorid but shows extreme axe-shaped development of the third antennal segment (as in some undescribed Australian forms) or other apomorphies in the structure of the antennae is more likely a tachinid.

The rhinophorid arista is often short-plumose or, more rarely, long-plumose, but when plumosity occurs it affects the whole length of the arista (though gradually and evenly becoming shorter in most cases towards the aristal tip). The kind of arista characteristic of most sarcophagines in which the basal half is long-plumose and the apical half bare does not occur in Rhinophoridae and any specimen showing this kind of arista is likely to belong in Sarcophagidae or Calliphoridae.

Characteristics of Rhinophoridae and family limits

Family **RHINOPHORIDAE** Robineau-Desvoidy

RHINOPHORIDAE Robineau-Desvoidy, 1863 : 3. Type-genus: *Rhinophora* Robineau-Desvoidy, 1830.
PHYTIDAE Robineau-Desvoidy, 1863 : 45. Type-genus: *Phyto* Robineau-Desvoidy, 1830. (PHYTOIDAE: Brauer & Bergenstamm, 1889 : 111 (43).)
MELANOPHORINI Lioy, 1864 : 68. Type-genus: *Melanophora* Meigen, 1803.
MORINIINI Townsend, 1919*b* : 546. Type-genus: *Morinia* Robineau-Desvoidy, 1830.
MELANOMYINI Townsend, 1919*b* : 548. Type-genus: *Melanomya* Rondani, 1856.
EOPHYTOINI Townsend, 1931 : 383. Type-genus: *Eophyto* Townsend, 1919 [subjective synonym of *Stevenia* Robineau-Desvoidy, 1830].
ACAMPOMINTHOINI [sic] Townsend, 1935 : 111, 253. Type-genus: *Acompomintho* Villeneuve, 1927. (ACOMPOMINTHOINI: Townsend, 1939 : 252.)
AZAISIINI Herting, 1961 : 1, 4, 33. Type-genus: *Azaisia* Villeneuve, 1939.
? STACKELBERGOMYIIDAE Rohdendorf, 1948 : 455. Type-genus: *Stackelbergomyia* Rohdendorf, 1948.

Family of Calyptrata Muscoidea s. l. with following characters (*Bequaertiana* omitted).

IMAGO. Head widely dichoptic in ♀, widely dichoptic to near-holoptic in ♂. Eyes bare. Eye facets never greatly enlarged in either sex. Ocelli present. Ocellar setae usually present and proclinate (outwardly-directed in *Oplisa* Rondani). Inner vertical setae subparallel (cruciate sometimes in *Morinia* ♀, absent *Morinia* ♂). Frontal setae well differentiated. ♀ with prevertical setae (except *Morinia*), ♂ with or without prevertical setae. ♀ with proclinate orbital setae (very rarely undifferentiated), ♂ with or without proclinate orbital setae. Lunula bare. Face non-carinate. Facial ridges without strong setae. Head vestiture black. Antennae always simple, arista varied (but never long-plumose basally and bare apically, cf. *Sarcophaga* Meigen). Palpi present. Oral cavity and proboscis almost always well developed, latter very

short to longer than head-height. Acrostichal setae varied. 2+3 *dc* setae (exceptionally one *prst dc*). 0+2 *ia* setae (small *prst ia* and a third *post ia* in some specimens of *Phyto*). 2–3 humeral and 2 notopleural setae. One (inner) posthumeral seta (but a very fine outer posthumeral haphazardly occurring in *Phyto* in a position laterad of presutural seta). Presutural seta always present. Pre-alar seta varied. 1–2 *sa* setae. 2 postalar setae. Scutellum with basic plan of two pairs of marginal setae (laterals and apicals), occasionally supplemented by a pair of basal and discal setae; apical setae cruciate or strongly convergent. Propleuron bare. Prosternum bare (exceptionally with a lateral hair in *Melanomya*). Propleural and prostigmatic setae present. Sub-alar bulla bare. 2–3 *stpl* setae (except one in *Macrotarsina*). Pteropleural seta varied (but never very strong). Barette bare (except occasionally with hairs in *Phyto*). Hypopleural setae present. Pleurotergite bare. Mediotergite usually with infrasquamal hairs. Postalar wall and suprasquamal ridge bare. Postscutellum undeveloped (as Calliphoridae). Metathoracic spiracle without 'operculum', with short anterior and posterior projecting fringes of subequal size (Figs 41–44) (except in *Termitoloemus* in which fringed with long strong sparse black hairs). Posteroventral declivity of the thorax membranous medially (metathorax 'open'). Fore coxa bare on inner anterior surface. Fore tibia with *ad* setae and one *pv* seta (*very* exceptionally two *pv* or none). Mid tibia with one or more *ad* setae, two or more *p-pd* setae and a submedian *v* seta (very rarely absent). Hind coxa bare on posterodorsal surface. Hind tibia with three dorsal preapical setae (*ad*, *d*, *pd*), at least one *ad* seta and at least two *pd* setae, at least one *av* seta and never *pv* setae, usually with *pv* apical seta. Wing veins bare excluding basal node of R_{4+5} (except some *Stevenia* with R_{4+5} setulose as far as *r–m*, and except *Termitoloemus* in which R_1 and R_{4+5} finely setulose along their length); stem-vein bare. Bend of vein M without M_2 appendix or fold and section of M from bend to wing edge (M_1) not inflexed (M_1 sometimes missing and occasional specimen of *Paykullia* with very short M_2 stub). Second costal sector very short (not longer than *m–cu*), usually haired ventrally. Costal spine usually well developed. Lower calpyter small and rounded, inner margin widely divergent from scutellum (except *Angioneura acerba* (Meigen) with broad calypter), bare except for marginal fringe. Abdomen elongate, subovate or subfusiform, T1+2 not excavate to hind margin. ♂ abdomen with sternites 1–4 wholly or partially exposed (ventral ends of T1+2, T3 and T4 not meeting in mid-venter). ♂ sternite 5 bifid with large lateral lobes (except in *Paykullia*). ♂ postabdomen with sclerotized T6 and large T7+8 (latter usually partly visible in situ), paired and unfused cerci (? *Termitoloemus*) and short distiphallus. ♀ postabdomen forming a long retractile telescopic ovipositor (except short in *Melanophora* and *Paykullia*). Approximate size range: body length 3·0–11·0 mm, wing length 2·5–7·5 mm.

Early stages. *Egg:* plano-convex with fusiform outline, soft thin white shell, and hexagonally reticulate or branched longitudinal ridged sculpture; length 0·46–0·91 mm, maximum width 0·14–0·22 mm, maximum thickness 0·125–0·200 mm. *First-stage larva:* elongate-subfusiform or dorsoventrally compressed, integument warty and with sclerotized scales or tubercles or pseudopod-like processes; buccopharyngeal armature with paired mandibular sclerites, each with two or more teeth, and with extreme attenuation of anterior part of pharyngeal sclerite; metapneustic; length 0·44–1·00 mm, maximum width 0·075–0·240 mm. *Second-* and *third-stage larvae:* elongate, but of varied shape, sometimes fusiform, with virtually bare cuticle or with extensively microspinose cuticle; metapneustic or amphipneustic, posterior end of third-stage larva usually produced into a constricted cylindrical form bearing the posterior spiracles. *Puparium:* typical barrel-shaped form, posterior spiracles not recessed but borne prominently on a narrowed cylindrical extension or conical prominence, with three or four simple straight radiating slits (puparium sometimes rather flattened and arcuate in response to host's body form). [Foregoing information from Thompson (1934) and Bedding (1973).]

Host relations. Oviparous, incompletely incubated eggs deposited away from the host. Larval stages endoparasitic in woodlice (Crustacea : Isopoda) of several genera. [Several vague and unsubstantiated records in the literature of parasitism on other groups need to be discounted at present, but if *Angioneura obscura* (Townsend) is a true rhinophorid (see later discussion) then parasitism on land-snails (Mollusca) evidently occurs (Reinhard, 1929).]

Distribution. Primarily Arctogaean, a few species occurring in North America and one species as an immigrant in the Neotropical Region. *Palaearctic Region*: ranging from western Europe to Japan, northwards to British Isles and southern Scandinavia, southwards to North Africa, Mediterranean islands and Middle East; present in Canary Islands, Madeira and Azores, absent from Iceland. *Oriental Region:* poorly known, recorded only from Nepal, Ceylon (Sri Lanka), India and Formosa. *Afrotropical Region:* mainly southern and eastern Africa, but occurring also in Congo Basin and West Africa if *Bequaertiana* and *Parazamimus* are accepted as Rhinophoridae; present in Cape Verde Islands, Socotra and Comoro Islands; unknown from Madagascar,

Seychelles, Réunion, Mauritius; absent from Aldabra, Ascension, St Helena, Tristan da Cunha. *Australasian Region*: unknown.

[The Australian diptero-fauna contains several undescribed genera and species of aberrant calyptrates that are difficult to place reliably to family and could be confused with Rhinophoridae. Those that I have examined appear to be aberrant Tachinidae despite the small calyptrae and the feebly developed postscutellum.]

DISCUSSION. The family Rhinophoridae as here characterized is a small group, containing some 23 genera and about 85 species. Rohdendorf (1964 : 18) gives the number of species as 106, but this higher number is probably due to Rohdendorf accepting several names as valid that are actually synonymous and to the inclusion of some forms of doubtful taxonomic position. Except for a few atypical genera (which are possibly not rhinophorids at all) the family is moderately homogeneous and its satisfactory classification does not necessitate the recognition of any taxa ranked between generic and family level; no subfamilies or tribes are recognized. The following discussion briefly considers the tribal classification of earlier authors and the various aberrant genera that lie outside the limits of the Rhinophoridae as here treated.

Suprageneric classification. Townsend (1935; 1938) in his *Manual of Myiology* placed nearly all the genera that recent authors have regarded as Rhinophoridae in the family Melanophoridae, and divided this family into the five tribes Melanophorini, Moriniini, Eggisopsini, Acompominthoini (as Acampominthoini in error) and Villeneuviellini, of which the last two were monogeneric. This classification cannot be in any way equated with the current concept of Rhinophoridae – even though it embraced most of the rhinophorid genera – because the first three of Townsend's tribes just listed contained genera now considered to belong in the Tachinidae, Sarcophagidae or Calliphoridae (with *Villeneuviella* Austen, the only genus of Villeneuviellini, also now being considered a calliphorid (Zumpt, 1956*a* : 130)). Hence although *Melanophora* (type-genus of Melanophoridae) is a rhinophorid, Townsend's sense of Melanophoridae is that of a taxonomic pot-pourri lacking equivalence to the present-day Rhinophoridae. (In all, Townsend's Melanophoridae included 80 nominal genera of which only 34 belong to Rhinophoridae in the current sense. The discrepancy between 34 nominal rhinophorid genera and the 23 genera here treated as valid arises from the fact that Herting (1961) has rightly synonymized many generic names of Palaearctic forms that Townsend accepted as valid.)

Townsend's tribe Acompominthoini contained only the oriental rhinophorid genus *Acompomintho*, and indicates Townsend's penchant for unnecessary tribal splitting. *Acompomintho* differs from other rhinophorids known to Townsend only in the higher than usual antennal axis and correlated features of long facial profile and long antennae (Townsend, 1935 : 111), and this was the only basis on which Townsend erected the tribe Acompominthoini. This tribe is given no validity here, as there are various intermediates occurring in rhinophorids between those with very short antennae and low antennal axis and those with the *Acompomintho* facies. It should be noted, though, that Herting (1961) was also impressed by this character and proposed the tribe Azaisiini for forms with high antennal axis, and longer-than-usual antennae, and elongate second aristal segment (including in it two genera, *Acompomintho* and *Azaisia*, the former from Formosa and the latter from Madeira). (Nomenclaturally Herting was in error to propose the name Azaisiini as Townsend's earlier name Acompominthoini was available for Herting's tribal taxon.)*

Excluded genera of uncertain taxonomic position. The calyptrate flies contain several anomalous genera that can, on present evidence, be assigned to a family only by guesswork and that cut across the conventionally accepted characters that differentiate the major families. Some of these genera have been placed in, or closely associated to, the Rhinophoridae and require comment in the light of their present exclusion from Rhinophoridae.

* Herting did not see the genus *Azaisia* and treated it on the basis of Villeneuve's description. The holotypes of both its species, *A. obscura* Villeneuve and *A. setitarsis* Villeneuve, have been studied during the present work through the courtesy of their loan by Dr Vanschuytbroeck from IRSNB, Brussels.

Stackelbergomyia Rohdendorf. This curious genus, containing a single deserticolous species from the U.S.S.R., was described by Rohdendorf (1948) and placed by him in a new family of its own, Stackelbergomyiidae, near to the Rhinophoridae. To judge from the description this approximate placement is correct, although (contrary to the implication of the title of the paper containing the description) it is not known that *Stackelbergomyia* is parasitic. No material has been seen of *S. arenaria* Rohdendorf, and I can add nothing to what is known at first hand, but the figures suggest some resemblances that may or may not be significant. The wing of *Stackelbergomyia* (with its loss of M_1 and setulae on R_1) and the head profile, including the diminutive antennae, are extremely similar to those of the tropical African genus *Bequaertiana* (which in the present work is included, with considerable uncertainty, in the Rhinophoridae) and phyletic affinity with this genus seems possible. But the rather incrassate legs and strong leg vestiture are very different from those of typical rhinophorids and strikingly different from *Bequaertiana* (in which the legs are devoid of strong setae or long hair); on the other hand, the rather short thick legs recall those of the Indian genus *Termitoloemus* (here accepted as a rhinophorid) and the slight possibility of relationship between *Stackelbergomyia* and *Termitoloemus* exists (although not supported by the extremely different form of distiphallus in the two genera: cf. figures in original descriptions).

Shannoniella Townsend and *Bezzimyia* Townsend. Shortly after publishing his five-tribe system for the Melanophoridae in the *Manual of Myiology* Townsend (1939) added a sixth tribe, the Shannoniellini, based on a new monotypic genus (*Shannoniella*) from Brazil. In describing the new genus and tribe he compared it to Acompominthoini, monotypic for *Acompomintho*, and thereby implied that *Shannoniella* might be a rhinophorid (as *Acompomintho* certainly belongs to the Rhinophoridae). I have not seen *Shannoniella* but from description it is evidently close to the New World genus *Bezzimyia* Townsend, of which (through the courtesy of Dr Sabrosky) I have seen material from North America. *Bezzimyia* was placed by Townsend in the Melanophorini and by Sabrosky & Arnaud (1965) in the Rhinophorinae, but Guimarães (1971 : 112) has placed *Bezzimyia* together with *Shannoniella* in the tribe Shannoniellini and has assigned this tribe to the Tachinidae near to the Minthoini. From my own examination of *Bezzimyia* during the present work I have formed the same opinion as Guimarães, and consider him to be right in removing *Bezzimyia* from the rhinophorids and treating it as a minthoine-like tachinid. The head facies with greatly enlarged and densely setulose facial ridges is conspicuously tachinid, and the enlarged fore tarsi of the female are of the minthoine type, but the postscutellum is undeveloped. Hosts are unknown for both *Bezzimyia* and *Shannoniella*.

Opsodexia Townsend. This genus is excluded here from the Rhinophoridae, as I believe its affinities to be almost certainly with the Calliphoridae, although Downes (1965) has sunk the taxon to subgeneric status within *Melanomya* (a genus belonging to the Rhinophoridae in most dipterists' opinion although treated as forming a monogeneric tribe, the Melanomyini, by Downes). I am doubtful whether Downes is justified in synonymizing *Opsodexia* (and in turn its own synonyms, *Phalacrodexia* Townsend and *Opelodexia* Reinhard) with *Melanomya* and consider the synonymy insufficiently substantiated to accept here. Thus, following Herting (1961), I treat *Melanomya* as a genus of Rhinophoridae, but regard *Opsodexia* as a genus of Calliphoridae. *Opsodexia* is a small North American genus with a conspicuously calliphorid-like head (including long plumosity on the arista that is unlike that of rhinophorids but similar to that of many calliphorids) and with haired propleuron and prosternum. The character of hairing on both propleuron and prosternum is specially noteworthy, as the propleuron is bare in all Rhinophoridae (whereas it is very commonly haired in Calliphoridae) and the prosternum is bare in Rhinophoridae except for the very occasional adventitious hair in isolated specimens of *Melanomya*.

Villanovia Strobl. Townsend (1938 : 241) thought that this genus, which he had not seen, was probably synonymous with *Tromodesia*. If so, it would belong in the Rhinophoridae. Herting, however, has recently seen the type of the type-species of *Villanovia*, namely *Phyto aperta* Strobl, and has found that it is a specimen of *Billaea villicornis* (Zetterstedt) and therefore belongs in the Tachinidae (see Morge, 1974 : 295).

Catharosia Rondani, *Cinochira* Zetterstedt, *Litophasia* Girschner. These genera have from time to time been placed in the rhinophorines (e.g. van Emden (1954), dealing with the British fauna, put *Cinochira* and *Litophasia* in Rhinophorinae) but it is now well established and accepted that they are phasiine Tachinidae. They are not considered further here, except to note that an undescribed species of *Litophasia* (a genus not previously recorded from the Afrotropical Region) occurs in South Africa.

Included genera possibly not Rhinophoridae. The genera *Termitoloemus*, *Parazamimus* and *Bequaertiana* are inadequately known to be placed reliably to family but are here accepted as Rhinophoridae. They are discussed more fully elsewhere in this work. Only *Melanomya* and *Angioneura* require comment here. These genera are regarded as distinct by Herting (1961), who treats them as rhinophorids (as have earlier workers such as Villeneuve, Séguy and van Emden), but Downes (1965) takes a quite different view and treats *Angioneura* as a subgenus of *Melanomya* and the latter as constituting the tribe Melanomyini in Calliphoridae. Downes does not comment on the rhinophorids, but remarks that 'Although members of this group [Melanomyini] have also been placed in the Sarcophagidae or Tachinidae, a better case can be made for assigning them to the Calliphoridae'. The case is not made clear because of lack of space in a catalogue entry, but is evidently based on the fact (still poorly attested and under-referenced in the literature) that some *Melanomya* (sensu Downes) species in North America are parasitic on snails (in the manner of certain calliphorids, instead of on woodlice as in rhinophorids). Unfortunately there seem to be no host records for *Melanomya* and *Angioneura* in Europe, at least Herting (1961) gives none and I have not come upon any (but have not made an exhaustive literature search). Hence there is still uncertainty as to whether true *Melanomya* and *Angioneura* (both based on European type-species, although the New World species assigned to the latter by Downes appear to be correctly associated in the same taxon) are rhinophorids on the basis of host-relations; but at least they appear to be so on the basis of their adult morphology. On this account I follow Herting and continue to consider them as Rhinophoridae.

INVENTORY OF RHINOPHORID GENERA. To conclude this Section I give below an alphabetical inventory of the genera that I accept on present evidence as constituting the family Rhinophoridae, with an indication of the number of species in each genus and their zoogeographical provenance.

Acompomintho Villeneuve, 1927 [1 species, Oriental]
  Wagneriopsis Townsend, 1927
Angioneura Brauer & Bergenstamm, 1893 [3 species, Palaearctic; 5 species, Nearctic]
  Opelousia Townsend, 1919
  Angioneurilla Villeneuve, 1924
  Opsodexiopsis Townsend, 1935
Azaisia Villeneuve, 1939 [2 species, Palaearctic]
  Azaisiella Villeneuve, 1939
Bequaertiana Curran, 1929 [2 species, Afrotropical]
Cirillia Rondani, 1856 [1 species, Palaearctic]
  Kockia Robineau-Desvoidy, 1863
Comoromyia gen. n. [1 species, Afrotropical]
Macrotarsina Schiner, 1857 [1 species, Palaearctic]
  Zelleria Egger, 1856, preocc.
  Braueria Schiner, 1861
Melanomya Rondani, 1856 [1 species, Palaearctic]
Melanomyoides gen. n. [1 species, Afrotropical]
Melanophora Meigen, 1803 [1 species, widespread]
  Illigeria Robineau-Desvoidy, 1830
Morinia Robineau-Desvoidy, 1830 [2 species, Palaearctic]
  Calobataemyia Macquart, 1855
  Anthracomya Rondani, 1856
  Disticheria Enderlein, 1934
Oplisa Rondani, 1862 [3 species, Palaearctic]
  Melanomelia Strobl, 1899
  Anoplisa Herting, 1961
Parazamimus Verbeke, 1962 [1 species, Afrotropical]
Paykullia Robineau-Desvoidy, 1830 [8 species, Palaearctic]
  Chaetostevenia Brauer, 1895
  Parafeburia Townsend, 1933
  Euplesina Wainwright, 1933
Phyto Robineau-Desvoidy, 1830 [12 species, Palaearctic; 5 species, Afrotropical]
  Savia Rondani, 1861
  Metopisena Rondani, 1862
  Semitachina Portschinsky, 1883
  Paramorinia Brauer & Bergenstamm, 1891
  Styloneuria Brauer & Bergenstamm, 1891
  Britea Curran, 1927 **syn. n.**

Protachaeta Enderlein, 1936
Queximyia gen. n. [1 species, Afrotropical]
Rhinomorinia Brauer & Bergenstamm, 1889 [2 species, Palaearctic; 1 species, Oriental; 9 species, Afrotropical]
Oxytachina Brauer & Bergenstamm, 1891 **syn. n.**
Pseudophania Brauer & Bergenstamm, 1893 **syn. n.**
Dewetia Bischof, 1904 **syn. n.**
Rhinophora Robineau-Desvoidy, 1830 [1 species, Palaearctic]
Stevenia Robineau-Desvoidy, 1830 [13 species, Palaearctic; 1 species, Oriental; 1 species, Afrotropical]
Ptilocheta Rondani, 1857
Trisoneura Lioy, 1864
Eophyto Townsend, 1919 **syn. n.**
Ptiloceroides Villeneuve, 1924
Termitoloemus Baranov, 1936 [1 species, Oriental]
Tricogena Rondani, 1856 [1 species, Palaearctic]
Talmonia Robineau-Desvoidy, 1863
Frauenfeldia Egger, 1865
Tromodesia Rondani, 1856 [1 species, Palaearctic]*
Ventrops gen. n. [1 species, Afrotropical]

* No material of *Tromodesia* is in BMNH collection and this is the only genus in the foregoing list which has not been seen.

Taxonomic characters and generic classification

The Rhinophoridae, except for a few distinctive species, are hard to classify into clear-cut genera and the characters that should be used for generic definition are far from clear. Although the early stages are known for a few Palaearctic species the information from eggs and larvae is still too fragmentary to be embodied in a classification that takes account of all stages in the life-history. It is already obvious, however, that an harmonious generic classification based on all stages will be hard to achieve, because there are major incongruities between how species group on the adult stage and how they group in the early stages – and even between groupings based on eggs and groupings based on first-instar larvae. Bedding (1973), for example, has shown that *Phyto melanocephala* (Meigen) and *Phyto discrepans* Pandellé have the same kind of egg (with longitudinal ridges instead of the hexagonal reticulation found in other known rhinophorid eggs) but that they have conspicuously different first-stage larvae – which are at least as distinct from each other as either is from the first-stage larva of *Melanophora roralis* or of *Paykullia maculata* (Fallén); Bedding concludes from this that *melanocephala* and *discrepans* should not be congeneric despite the very similar adults, though he does not make clear why differences in first-instar larvae should necessarily be given more taxonomic weight than resemblances in eggs and adults.

Lacking sufficient knowledge of juvenile stages the generic classification must still be based on adult flies alone, and the object of this section is to call attention to the features of adult morphology that appear to have taxonomic value – especially at generic level, but to some extent at species level also. In doing so it is useful, as a standard of comparison, to refer to the monograph of Herting (1961) on Palaearctic rhinophorids, as the major part of the known rhinophorid fauna occurs in the Palaearctic area, and Herting's work is the only recent one of significance in classification.

Herting includes the 51 generically placed Palaearctic species in 15 genera, and this small ratio (3·4 species per genus) is reminiscent of the situation in Tachinidae where all classifications recognize a rather large number of (on average) small genera. In this work on Afrotropical forms I place the 23 species in ten genera, but these figures include two species that are essentially Palaearctic elements that just reach into the northern fringe of the Afrotropical Region (viz. *Melanophora roralis* in Cape Verde Islands and a new species of *Stevenia* in Socotra); omitting these two species and considering the Afrotropical fauna proper there are 21 species in eight genera, a ratio approximating to that of Herting for the Palaearctic fauna. In general, therefore, the entities that I recognize as genera for the Afrotropical fauna are closely in balance with Herting's classification, and we both recognize character gaps between genera of about the same scale – and both accept several genera as being monospecific on present evidence (seven Palaearctic and six Afrotropical). In the case of the Afrotropical Region, however, it is virtually certain that more species remain to be discovered, and this is likely to make the genus–species ratio even more comparable to the current treatment of Palaearctic forms. In the long term,

though, it is likely that today's generic concepts will be considered too restrictive and that more complete knowledge of biology will render broader genera desirable.

The following account of taxonomic characters is based on a general study of the Rhinophoridae in the BMNH collection and on other material seen for this work.

Head characters

Evolutionary differentiation has evidently affected the rhinophorid head more profoundly than any other part of the external adult morphology (though this cannot be seen as in any way adaptive to what is known of the biology). The head shape provides one of the most important clues for the aggregation of species into genera, and some genera have extremely characteristic head profiles (see Figs 8–17). The features that account for the various shapes are, particularly, the degree of prominence or of recessiveness of the vibrissal angles (and epistome) and the associated concavity of the facial profile, the eye form and depth of the gena, the ventral outline of the head, and the height of the antennal axis in relation to the eye. All these provide useful generic characters. Forms with a high antennal axis (*Queximyia*, *Acompomintho*) usually have long antennae and a long straight facial profile with the vibrissae inserted almost at the lowest point of the head. Many forms (*Phyto*, *Rhinomorinia*, *Rhinophora*, *Oplisa*, *Melanomyoides*) have a characteristic anteroventral angulation of the head (e.g. Figs 8–10, 12, 16) and the vibrissae inserted on prominent vibrissal angles well above the lowermost point of the head, the genera involved evidently forming a phyletically close-knit group (which could perhaps be legitimately merged into one genus). An exceptional head shape occurs in *Ventrops* (Fig. 13) in which the eye-profile is excavate posteriorly and the gena reduced to a very narrow strip (nothing comparable occurs elsewhere in the family).

Degree of separation of the male eyes varies interspecifically but in itself is not significant for generic definition. In some genera (*Phyto*, *Rhinomorinia*) very closely related species may differ widely in male frons width, and since the near-holoptic condition is associated with loss of prevertical and proclinate orbital setae in males it is the case that presence or absence of these setae is not necessarily of generic significance. The most important character of head chaetotaxy is presence or absence of strong setae (as distinct from hairing) on the parafacials, and presence of parafacial setae is one of the significant diagnostic characters for several genera (*Stevenia*, *Tricogena*, *Cirillia*, *Acompomintho*) (Fig. 15). The antennae, palpi and proboscis are of little use for generic classification (though the proboscis can be unusually elongate in some species: Figs 9, 11), but the arista has some value. In most forms the arista is thickened only near the base and has both basal segments extremely short, but a very few forms have the arista thickened for over half its length and the second aristal segment conspicuously elongate (*Azaisia*, *Acompomintho*).

Thoracic characters

The most important character of the thorax at generic level appears to be the pre-alar seta, and Herting's (1961) generic key uses the size of this seta (whether strong or absent to very weak) to differentiate groups of genera. In working the Afrotropical fauna I have found that this seta is similarly important and that its size assists in the delimitation of genera. It is largely on the basis of this seta that I differentiate *Phyto* (*pra* seta very strong) from *Rhinomorinia* (*pra* seta very weak or absent), genera which are very close to each other in head shape, male terminalia and chaetotaxy generally and difficult to distinguish if the pre-alar seta is not considered. Other setae of the chaetotaxy, and non-chaetotactic characters, of the thorax are of limited taxonomic value.

Leg characters

Herting (1961) writes that 'Die Chätotaxie der Beine, speziell der Tibien, ist systematisch wichtig' but in the main this is true at specific level rather than generic, although number of *av* setae on the hind tibia (one or two) and of *ad* setae on the mid tibia has some limited usefulness. In general the leg chaetotaxy is extremely stable throughout the rhinophorids (almost all forms having *ad* setae and one *pv* seta on the fore tibia, two *p* and a *pv* seta plus a *v* seta on the mid tibia, and two

ad and two *pd* setae on the hind tibia). A rather unusual character in some species is the occurrence of setae on the *posterodorsal* surface of the fore tibia (a position in which setae virtually never occur in tachinids), but this is of specific and not generic value; *pd* setae on the shaft of the fore tibia are less usual in the Afrotropical forms than in Palaearctic forms, but occur in *Stevenia socotrensis* and *Rhinomorinia setitibia*.

Wing characters

The wings offer some useful characters for generic classification, particularly in the petiolation of cell R_5 and the angulation of vein *M*. It is clear that whether cell R_5 is just open at the wing edge or just closed or very short-petiolate is of no significance generically and often not specifically; but the presence of a really *long* petiole (i.e. a petiole about as long as *m–cu* or longer) – which is normally associated with extremely abrupt flexing of *M* (at about 110–120°) – in contrast to no petiole can justifiably be used as a good generic character (cf. Figs 25, 26 with Figs 20–24). Size of the costal spine, extent of setulae on the base of R_{4+5}, obliquity of *m–cu*, position of *m–cu* in relation to *r–m*, etc. all have some taxonomic use at specific level but very little at generic. In some instances the vein-plan is so distinctive that the genus can be instantly recognized from a figure (e.g. *Melanophora*, Fig. 25). The hairing of the underside of the second costal sector (a character of considerable taxonomic value in Tachinidae) has been examined throughout the Rhinophoridae but has not been found useful; typically rhinophorids have this sector finely haired, but the hairing is often sparse or haphazardly present and sometimes absent.

Abdominal characters

Preabdominal structure is very uniform and offers no characters, but the chaetotaxy of T1+2 (presence or absence of median marginal setae), T3 (presence or absence of median marginals or discal setae) and T4 (presence or absence of median discal setae) can be useful at specific, and to some extent generic, level. The fifth sternite of the male is bifid with simple lateral lobes (often extremely large and downwardly prominent) but is of no value generically (except to the extent that *Paykullia* differs from other genera by having a simple transverse plate-like St5 lacking a median incision). The male hypopygium offers extremely useful characters at specific level in the form of the cerci and surstyli, and probably also the distiphallus and other phallic structures, but a more critical study is needed than I have been able to give here for determining whether the genitalia offer good generic differences. There is variation in the size and bristling of the epandrium (T9), T7+8 and T6, but it is doubtful whether this is of more than specific significance. Specially interesting, however, is the structure of the ejaculatory sclerite, which in *Oplisa* attains a gigantic size and reaches well forwards into the preabdomen as a large oval plate (weakly sclerotized anteriorly) (Fig. 40) and which at its base within the postabdomen is articulated to a strongly sclerotized broken annulus. This type of ejaculatory sclerite is very different from the small or medium-sized slightly clubbed or fan-shaped sclerite that is found in the other genera for which I have examined the ejaculatory sclerite (*Phyto*, *Rhinomorinia*, *Melanomya*, *Melanomyoides*, *Melanophora*, *Stevenia*, *Angioneura*, *Termitoloemus*). This character, and the detailed structure of the phallus, might re-pay further study and shed more light than we have at present on generic and specific affinities.

The female postabdomen has not been investigated for this paper, but is of the normal long telescopic type in all the Afrotropical forms in which it can be seen in situ on specimens. Herting (1961) notes that only *Melanophora* and *Paykullia* (syn. *Chaetostevenia*) in the Palaearctic fauna have a short non-telescopic postabdomen. It is not yet clear whether valuable characters exist in the female terminalia, but from examination of projecting ovipositors on museum specimens it seems very unlikely that they do at generic level in the telescopic-postabdomen forms.

Systematic treatment of the Afrotropical fauna

Composition and distribution of the fauna

Because of the extreme paucity of material in Museum collections the Afrotropical rhinophorids have been very poorly known, and prior to the present revision only 10 nominal species

belonging to the group had been described from Africa south of the Sahara. Up to now these species have remained virtually unstudied, and not amalgamated into the present-day concept of Rhinophoridae (or Rhinophorinae). However, the fauna is much richer than a previous knowledge of a mere 10 species would suggest, and from assembly of material for the present study it has been possible to describe a further 13 new species (four of which require new genera because of the impossibility of assigning them convincingly to pre-existing genera). Even so it is more or less certain that only a small part of the actual rhinophorid fauna of Africa has yet been discovered, and I anticipate that when more fully worked out the Afrotropical fauna will be as rich as that of the Palaearctic Region (which at present numbers about 50 species). This paper is therefore only a beginning.

Of the 23 species here recognized in the Afrotropical Region all but one are endemic, the outsider being *Melanophora roralis* which is widespread in the Holarctic Regions and only just extends its range into the Afrotropical area (being present in the Cape Verde Islands). Despite the high degree of species-endemicity the general affinities of the Afrotropical fauna lie closely with the Palaearctic fauna, and four of the 10 genera here recognized in the Afrotropical fauna are common to both regions – and the four new genera are not fundamentally disjunct from the Palaearctic fauna (although there is no real equivalent in that fauna to the new southern African genus *Ventrops*).

The distribution of Afrotropical rhinophorids on the mainland of Africa seems (judging from the very limited material) to be centred on the temperate or subtropical parts of southern and eastern Africa, and the known fauna is much richer in South Africa than elsewhere. But assuming that the genera *Bequaertiana* and *Parazamimus* Verbeke are truly rhinophorids (as discussed elsewhere in this work) then the family is represented also in the tropical rain-forests of the Congo Basin and West Africa. These genera, however, are aberrant and strongly disjunct from other Rhinophoridae and normal forms that are unequivocally rhinophorids occur mainly in an arc from Namibia through South Africa, Mozambique and Rhodesia to Kenya (but so far without records from Tanzania).

Distribution on the peri-African islands is poorly known, but (as mentioned) *Melanophora roralis* occurs in the Cape Verde Islands, a species of *Stevenia* in Socotra and a species of the new genus *Comoromyia* in the Comoro Islands. In the islands associated with Palaearctic Africa a species of *Phyto* is found in the Canary Islands and two endemic species of *Azaisia* in Madeira (Villeneuve, 1939). Rhinophorids are almost certainly unrepresented in the well-collected islands such as St Helena, Seychelles, Aldabra and Mauritius, but probably occur in Madagascar (as there is at least one species in the Comoros). (Though scarcely relevant to Africa, the occurrence of one rhinophorid in the Azores may be noted, viz. *M. roralis* already mentioned in reference to the Cape Verde Islands).

There are no host records for Afrotropical Rhinophoridae but it can reasonably be assumed provisionally that they parasitize terrestrial Isopoda like the woodlouse-flies of other zoogeographical regions (although the possibility of parasitization of other arthropod groups such as the large African millipedes cannot be ruled out). The woodlouse fauna of the Afrotropical Region is extremely rich both in the tropical and the temperate parts of continental Africa, and woodlice are present also in the peri-African islands, and lack of suitable hosts is unlikely to be a factor limiting the distribution of African rhinophorids. The biology of Afrotropical woodlouse-flies offers an interesting field of investigation, particularly in South Africa where enquiry into the biology of relatively common coastal dune species such as *Rhinomorinia xanthocephala* should present little difficulty.

Key to genera

1 Wing with M_1 missing, cell R_5 therefore largely open posteriorly and venation without a 'bend' of vein M (Fig. 28). Intra-alar and posthumeral setae absent. Tibiae without clearly differentiated setae. Abdomen of ♂ [♀ not known] with thick and uniform covering of brilliant silver pollinosity. [West Africa to Uganda, forests] . . . ***BEQUAERTIANA*** Curran (p. 53)

– Wing with M_1 present, cell R_5 closed posteriorly and venation with a 'bend' of vein M. Intra-alar and posthumeral setae present. Tibiae with some or many clearly differentiated setae. Abdomen not so. 2

2 Wing with cell R_5 *very* long-petiolate (the petiole about as long as or longer than *m–cu*) and with the bend of vein *M* very strongly abrupt (changing direction at 110–120°) (Figs 18, 25, 26). [Insular species] 3
– Wing with cell R_5 open, closed at wing edge, or short-petiolate and with the bend of *M* widely obtuse (changing direction at about 140°) (Figs 19–24). [Continental species] . . . 5
3 Pre-alar seta very strong (larger than the notopleural setae). T1 + 2 without median marginal setae. Thorax uniformly covered with ashy grey pollinosity. Wing venation as Fig. 18. Abdominal ground colour tawny reddish yellow to reddish brown. [Comoro Islands] ***COMOROMYIA*** gen. n. (p. 46)
– Pre-alar seta absent or hair-like. T1 + 2 with median marginal setae. Thorax blackish without uniform covering of pale pollinosity. Wing venation not as Fig. 18. Abdominal ground colour black. [Not from Comoro Islands] 4
4 Parafacials with strong proclinate setae, head profile as Fig. 15. Intermediate abdominal tergites with discal setae. Wing venation as Fig. 26. Mid tibia with two *ad* setae. [Socotra] ***STEVENIA*** Robineau-Desvoidy (p. 48)
– Parafacials without setae, head profile as Fig. 17. Intermediate abdominal tergites without discal setae. Wing venation as Fig. 25. Mid tibia with one very small *ad* seta. [Cape Verde Islands] . . . . ***MELANOPHORA*** Meigen (p. 50)
5 Pre-alar seta strong (as large as or larger than the notopleural setae) 6
– Pre-alar seta absent or extremely weak (if present then always *much* weaker than the notopleural setae) 7
6 Legs and all thoracic and abdominal ground colour blackish; palpi blackish brown. Epistome weakly to strongly warped forwards from the face, facial profile therefore distinctly concave (Figs 11, 16); vibrissal angles conspicuously above the lowermost point of the head. Antennae small or medium-sized, not reaching the epistome. Presutural *acr* setae present. Intermediate abdominal tergites with or without discal setae. [East Africa and South Africa] ***PHYTO*** Robineau-Desvoidy (p. 39)
– Legs (except tarsi) and lateral parts of thorax and abdomen reddish yellow; palpi yellow. Epistome in the plane of the face, facial profile therefore almost straight (Fig. 14); vibrissal angles about at lowermost point of the head. Antennae very long, more or less reaching the epistome (Fig. 14). Presutural *acr* setae absent. Intermediate abdominal tergites each with a pair of median discal setae. [South Africa] . . . . ***QUEXIMYIA*** gen. n. (p. 45)
7 Head profile as Fig. 30; antennae extremely small, their length less than the depth of the gena. Legs and thoracic ground colour reddish yellow. Intra-alar setae standing very close to each other, anterior one much closer to posterior one than to transverse suture [? constant, only one specimen known]. Costa with unusually dense vestiture of long hairing in which spiniform macrotrichia not clearly differentiated. [Zaire] . . ***PARAZAMIMUS*** Verbeke (p. 51)
– Head profile not as Fig. 30; antennae medium-sized, their length greater than the depth of the gena. Legs and thoracic ground colour black or blackish brown. Intra-alar setae standing far apart, anterior one much closer to transverse suture than to posterior one. Costa normal, with strong spiniform macrotrichia along most of length as well as some hairing . . . 8
8 Eye in profile very large and reniform, occupying almost the whole side of the head and gena correspondingly reduced (genal depth less than width of third antennal segment, Fig. 13). Epistome about in the plane of the face. Vibrissal angles very weakly differentiated, *much* less prominent than the profrons, vibrissae inserted at a level above lowermost point of the *eye*. Parafacials invisible or almost so in profile (Fig. 13). Costal spine undifferentiated. Presutural *acr* setae absent. Halteres black. [eastern and southern Africa] ***VENTROPS*** gen. n. (p. 20)
– Eye in profile subovate or subcircular, not concave on hind margin and not occupying almost the whole side of the head (genal depth conspicuously greater than width of third antennal segment, Figs 8–10, 12). Epistome strongly warped forwards from the face. Vibrissal angles strongly differentiated, about as prominent as or more prominent than the profrons, vibrissae inserted a little below lowermost point of the eye. Parafacials visible in profile (Figs 8–10, 12). Costal spine strong. Presutural *acr* setae usually well defined. Halteres yellow. [southern Africa] 9
9 Wing cell R_5 with a petiole that is about one and a half times as long as *r–m* (Fig. 19). Scutellum with the lateral setae inserted much closer to the base than to the apical setae. Prescutum and scutum entirely without pale-pollinose vittae. Hind tibia with one *av* seta (exceptionally accompanied by an additional setula). Palpi very small (shorter than third antennal seg-

ment). ♂ head almost holoptic, frons without prevertical setae. ♂ genitalia with extremely large surstyli of cordate shape (Fig. 33) . . . . . ***MELANOMYOIDES*** gen. n. (p. 23)

– Wing with cell R_5 usually closed at the margin or very narrowly open (except in *setitibia* with *very* short petiole about half as long as *r–m*) (usually much as Fig. 22). Scutellum with the lateral setae inserted equidistantly between the base and the apical setae, or (in *xanthocephala*) closer to the apical setae. Prescutum or both prescutum and scutum with a pair of pale-pollinose (silvery or greyish) vittae (indefinite in *verticalis*). Hind tibia with two *av* setae. Palpi normal (at least as long as third antennal segment). ♂ head not almost holoptic and with prevertical setae (except in *capensis*). ♂ genitalia with elongate and often extremely narrow surstyli [not examined for all species] ***RHINOMORINIA*** Brauer & Bergenstamm (p. 25)

Genus *VENTROPS* gen. n.

Type-species: *Ventrops milichioides* sp. n.

Diagnosis. Head profile as Fig. 13. Eyes occupying almost all the side of the head and subreniform in outline (conspicuously concave on hind margin); gena correspondingly reduced, its depth less than the antennal width. Epistome in plane of the face or almost so, facial profile not concave. Vibrissal angle recessive, vibrissae inserted well above the lowermost point of the eye. Eyes of ♂ not approximated, frons equibroad in both sexes. ♂ with proclinate orbital setae, prevertical setae and small outer vertical setae as in ♀. Parafacials very narrow, invisible or almost so in profile, bare or with a few minute hairs at upper end. Antennae short, antennal axis below eye middle, antennal apices falling short of the epistome; arista long-pubescent. Proboscis very short. Pre-alar seta *very* small or hair-like, much smaller than notopleural setae. Presutural *acr* setae absent. Lower prostigmatic seta well developed, proclinate. Pteropleural seta small but clearly differentiated. Barette bare. Apical scutellar setae strong, subequal in size to lateral setae. Mid tibia with one (small) *ad* seta. Hind tibia with two or three *ad* setae, one *av* seta and a strong *pv* apical seta. Wing venation as Fig. 21: cell R_5 open at wing apex; bend of vein M gently rounded or at most slightly abrupt and very widely obtuse; *m–cu* straight and at right-angles to veins M and Cu_1; basal node of R_{4+5} setulose; costal spine undifferentiated. Abdomen without discal setae; T1+2 without median marginal setae. ♂ genitalia with small pointed cerci much shorter than surstyli, distiphallus similar to that of *Rhinomorinia*, and ejaculatory sclerite minute and rod-like.

Distribution. Eastern and southern Africa.

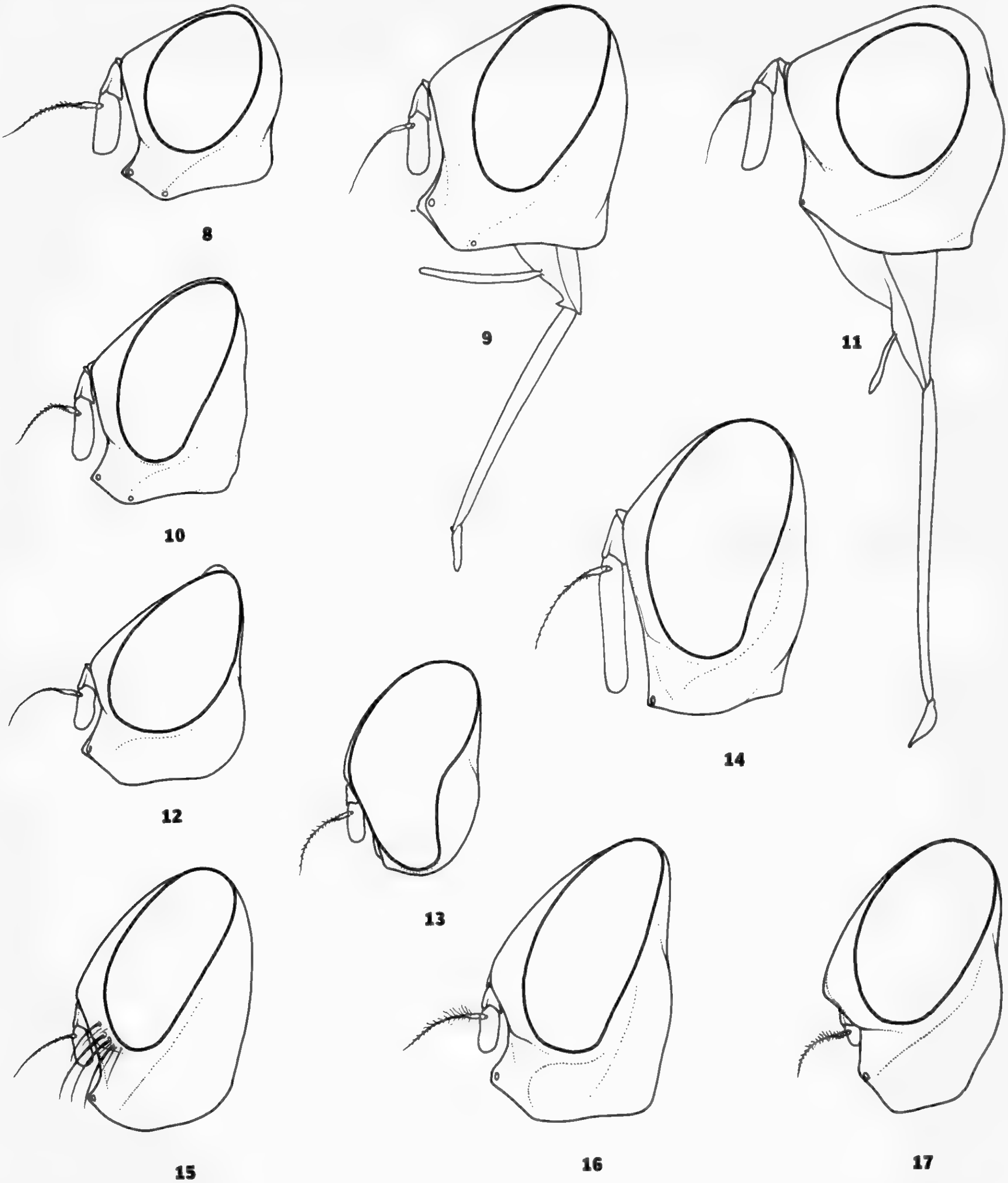
Discussion. This genus is erected for a new species that differs strikingly from all other Rhinophoridae in the conformation of the head. The eyes are exceptionally large, somewhat kidney-shaped in profile, and in the male in facial view they approach each other in an unusual way about at a level with the junction of the second and third antennal segments; in consequence of the eye shape the male head has the frontal region conspicuously narrowing at the lunula so that the upper facial region between the eyes appears distinctly 'pinched-in'. In both sexes the genal region is very reduced in association with the enlargement of the eyes so that it appears as a mere narrow strip between the lowermost point of the eye and the ventral margin of the head (Fig. 13), and the vibrissae (unlike those of any other rhinophorids known to me) are positioned well above the bottom of the eye.

This head conformation recalls that of certain Tachinidae, and combined with the small size and generally shining black appearance of the flies is specially reminiscent of some Dufouriini s. l. *Ventrops*, however, has all the characters of Rhinophoridae except for the atypical head and is undoubtedly rightly placed in this family. The small pre-alar seta, wing venation, and structure of the distiphallus of the aedeagus suggest a possible relationship to *Rhinomorinia*, but this genus and *Ventrops* could never be confused because of the very different head shape (cf. Figs 8–10 with Fig. 13).

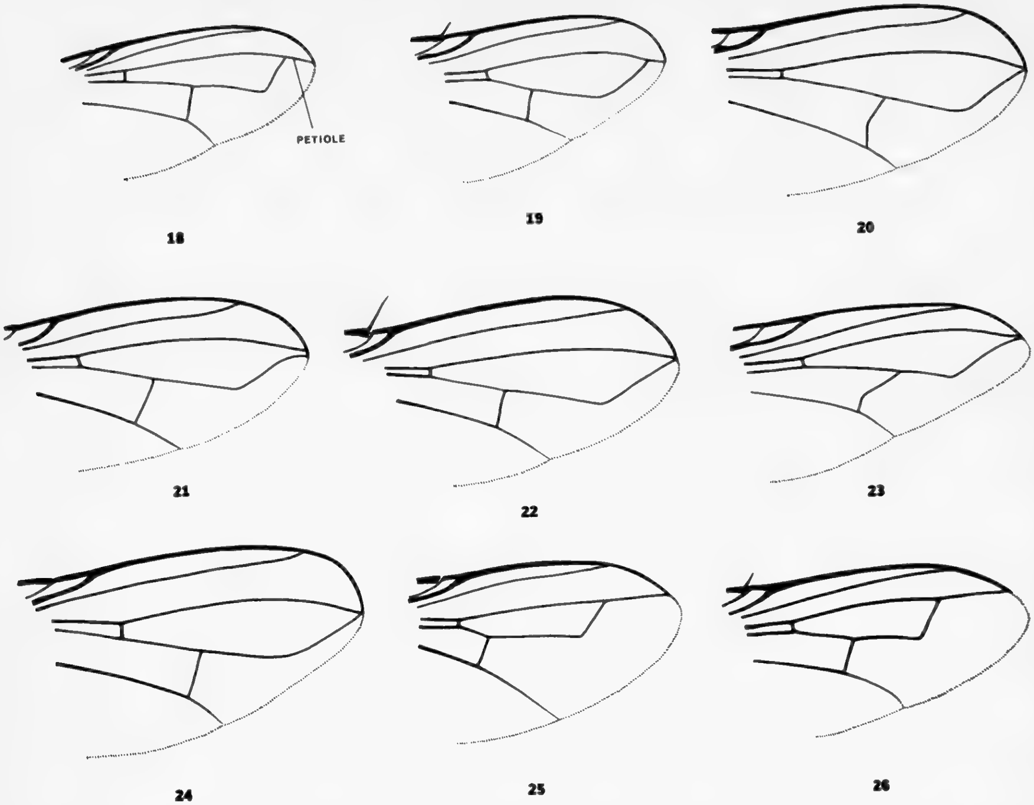
Ventrops milichioides sp. n.

Description. ♂. Head, antennae and palpi black. Head shape as Fig. 13. Frons with three pairs of proclinate orbital setae. Ocellar setae well developed, widely proclinate. Occiput not swollen, haphazardly covered with strong black setulae. Third antennal segment about twice as long as second. Thorax black and shining, dorsum with *very* inconspicuous trace of dark bronze-brownish pollinosity seen in some

lights. Three *stpl* setae. Infrasquamal hairs few, minute. Scutellum with a pair of small straight setae differentiated between the strong lateral and apical setae, and with a pair of very small setae differentiated basad of the lateral setae. Legs black; claws moderately long (fore claws nearly as long as last tarsal segment). Wings pale brown, infuscation weakening towards hind margin; basicosta blackish brown; halteres black. Wing venation as Fig. 21. Calyptrae whitish. Abdomen black and shining, T3 and T4 each with inconspicuous brownish grey pollinosity on the basal half; T3 with a pair of very strong erect median marginal setae; abdominal hairing recumbent. Measurements: body length 3·1 mm, wing length 2·6 mm [1 specimen].



Figs 8–17 Head profiles, in outline only, of Afrotropical Rhinophoridae. (8) *Rhinomorinia xanthocephala* (♂). (9) *R. vittata* (♀), mouthparts included. (10) *R. atra* (♂). (11) *Phyto longirostris* (♀), mouthparts included. (12) *Melanomyoides capensis* (♂). (13) *Ventrops milichioides* (♂). (14) *Queximyia flavipes* (♀). (15) *Stevenia socotrensis* (♂). (16) *Phyto tachinoides* (♂). (17) *Melanophora roralis* (♂). Setae omitted except for parafacial setae in Fig. 15.



Figs 18–26 Wings of Afrotropical Rhinophoridae, costal vestiture omitted. (18) *Comoromyia griseithorax*. (19) *Melanomyoides capensis*. (20) *Queximyia flavipes*. (21) *Ventrops milichioides*. (22) *Rhinomorinia xanthocephala*. (23) *Phyto tachinoides*. (24) *P. stuckenbergi*. (25) *Melanophora roralis*. (26) *Stevenia socotrensis*.

♀. Very like ♂, differing as follows. Eyes in facial view less strongly approached to each other, area of lunula and upper facial regions not noticeably constricted. Usually two pairs of proclinate orbital setae (but sometimes three). Claws very short. Abdomen non-pollinose and entirely shining black. Measurements: body length 2·9–4·2 mm, wing length 2·6–3·5 mm [4 specimens].

Material examined. Holotype ♂, Rhodesia: N. Vumba, 17.v.1964 (*D. Cookson*), in Natal Museum, Pietermaritzburg.

Paratypes. Rhodesia : 2♀, same data as holotype except dates 7.v.1964 and 7.iv.1965; 1 ♀, Lower Lundi River, Chipinda Pools, 2.xi.1960 (*R. Goodier*) (BMNH). Kenya: 2 ♀, Chyulu Hills, 1720 m, v.1938 (*Coryndon Mus. Exp.*) (BMNH).

Notes. The paratypes from Kenya lack the small setae on the scutellum between the lateral and apical setae that are present on the Rhodesian specimens, and also have weaker *post ia* setae than in the Rhodesian material, but I think nevertheless that all the material is probably conspecific.

Ventrops sp. indet.

In addition to the type-material of *V. milichioides* described above I have seen one other specimen of *Ventrops*. This specimen shows that the genus occurs in South Africa as well as Kenya and Rhodesia and almost certainly represents a second species of *Ventrops*. It is unjustified to describe it as a new species, since the differences from *milichioides* might not be significant and the male is

not known that would associate with it. The gena, though small, is wider than in *milichioides*, being almost as wide as the third antennal segment, and the wing is much less uniformly brown (brown colour occurring broadly along the costal margin, broadly along *M* to beyond *m–cu*, along Cu_1 and on *m–cu*, and the rest of the wing being hyaline). Data of the specimen are:

SOUTH AFRICA: 1 ♀, Transvaal, Kruger Park, Pretoriuskop area 2531Ab, 9.xii.1972 (*B. & P· Stuckenberg*) (NMP).

Genus *MELANOMYOIDES* gen. n.

Type-species: *Chaetostevenia capensis* Zumpt, 1959.

DIAGNOSIS. Head profile as Fig. 12. Eyes obliquely suboval in outline but more strongly pointed dorsally than usual; gena large, its depth much greater than antennal width. Epistome strongly warped forwards from the face, facial profile concave. Vibrissal angles sharp, about as prominent as the profrons, vibrissae inserted slightly below lowermost point of the eye but well above lowermost point of the head. Eyes of ♂ very strongly approximated. ♂ without proclinate orbital setae and without prevertical setae, with (small) outer vertical setae. Parafacials narrow but visible on their whole height in profile, totally bare. Antennae small, not reaching epistome, antennal axis below eye middle; arista bare. Proboscis short. Pre-alar seta hair-like, much smaller than notopleural setae. Presutural *acr* setae present. Lower prostigmatic seta very weak and slightly proclinate. Pteropleural seta hair-like. Barette bare. Apical scutellar setae extremely strong, crossing in basal half and slightly larger than lateral setae (latter inserted much closer to scutellar base than to apical setae). Mid tibia with one *ad* seta. Hind tibia with two *ad* setae, one *av* seta and a strong *pv* apical seta. Wing venation as Fig. 19. Cell R_5 closed and with medium-sized petiole about twice as long as *r–m*; bend of *M* gently and evenly rounded and widely obtuse; *m–cu* almost straight and about at right-angles to *M*; basal node of R_{4+5} with one strong setula (with or without additional hair); costal spine strong. Abdomen without discal setae on intermediate tergites; T1+2 without median marginal setae. ♂ genitalia with short cerci and surstyli of equal length, surstyli broadly foliaceous (Fig. 33); ejaculatory sclerite large and fan-shaped.

DISTRIBUTION. Known only from South Africa.

DISCUSSION. This genus is proposed for *Chaetostevenia capensis* Zumpt, a species that is difficult to place satisfactorily but which certainly does not belong to the European genus *Chaetostevenia* Brauer, 1895 (=*Paykullia* Robineau-Desvoidy, 1830). Zumpt (1959) assigned his new species *capensis* to *Chaetostevenia* simply because it ran down to this generic name in Séguy's (1941) key to European rhinophorine genera, and not on the basis of comparison with actual material of *Chaetostevenia*, and it seems unlikely that Zumpt would have described *capensis* in *Chaetostevenia* if material of this genus had been available to him. Although *capensis* shares a few characters with *Paykullia* (syn. *Chaetostevenia*), and even runs rather well to this genus in Herting's (1961) more recent key to European genera – because it has a petiolate R_5 cell, bare parafacials, short face, strong apical scutellar setae and a small pre-alar seta – there is scarcely any resemblance in the total facies. The head shape of *capensis* (Fig. 12), with its prominent vibrissal angles, excavate face and anteroventral angulation of the ventral outline, is nothing like that of *Paykullia* (in which the face is flat, the vibrissal angles undeveloped and the deep genal region regularly rounded), but instead is much closer to that of *Rhinomorinia* or even *Rhinophora*; and the wing venation is also different, despite common possession of a petiole, because in *Paykullia* the 'bend' of *M* is of the very abruptly 'right-angular' type and not of the widely obtuse type as in *capensis*. In short, I think it certain that there is no close phyletic relationship between the South African species *capensis* and the European genus *Paykullia* (i.e. *Chaetostevenia*), that *capensis* is misplaced and that *Paykullia* is not represented in the Afrotropical Region.

On the other hand, it is difficult to decide what to do with *capensis*, for whilst clearly not a *Paykullia* it is not unambiguously assignable to another described genus. In these circumstances I erect the new monotypic genus *Melanomyoides* for it, but with some reluctance, and certainly with the proviso that it might not be possible to maintain the genus as valid when much more is known about South African rhinophorids and their hosts. Future studies might show that *capensis* could be legitimately assigned to a widened concept of *Melanomya* or of *Angioneura* or of *Rhinomorinia*, to each of which it shows resemblances that might be indicators of close phyletic

relationship. Some of the main resemblances to, and distinctions from, these genera require enumeration.

Melanomyoides capensis (Zumpt) **comb. n.** is a small slender shining black species superficially extremely like the European *Melanomya nana* (Meigen), the only species of *Melanomya* in Herting's (1961) monograph and type-species of the genus. It greatly resembles *Melanomya* in the very strongly approximated male eyes and reduced frons and in the abdominal vestiture but differs by the very prominent epistome (face flat in *Melanomya*), bare arista (arista plumose in *Melanomya*), extremely strong apical scutellar setae (these very weak or hair-like in *Melanomya*), hair-like pre-alar seta (*pra* strong in *Melanomya*), and by the petiolate cell R_5 (this cell well open at the wing edge in *Melanomya*).

There is also a strong superficial resemblance between *M. capensis* and the European species *Angioneura fimbriata* (Meigen). Both are small slender shining black forms with strongly approximated male eyes and reduced frons (lacking proclinate orbital and prevertical setae, as also in *Melanomya*), but *capensis* differs from *Angioneura* by many of the same characters as differentiate it from *Melanomya*, such as the head shape, petiolate R_5 and the enormous apical scutellar setae. But *M. capensis* agrees with *Angioneura* in having the very small pre-alar seta, and on balance there is slightly closer agreement between *A. fimbriata* and *M. capensis* than between *M. nana* and *M. capensis*.

In the southern African fauna *M. capensis* is certainly closest to *Rhinomorinia*, and there is considerable correspondence between the characters of *Melanomyoides* and this genus. For example the head shape, in which the epistome is warped forwards from the face, the vibrissal angles very prominent and the ventral outline of the head distinctly angulate, is similar in both genera, but the genitalia of *M. capensis* are quite distinct from those of any *Rhinomorinia* species that has been examined, the surstyli being enormous flat subcordate plates (instead of the long narrow prong-like processes found in *Rhinomorinia* species). Surstyli of this broadly foliaceous kind are not found anywhere else in the Rhinophoridae to my knowledge (although male genitalia have not been examined for all genera), and the form of the male hypopygium, including aedeagal shape as well as the surstyli, supports the proposal of a new genus for *capensis*. There is a general resemblance between the distiphallus of *Rhinomorinia* and *Melanomyoides*, however, in so far as the anteromedian surface of the distiphallus is armed with numerous strong individual spines in both genera. Nothing comparable exists in the distiphallus of *Melanomya* or *Angioneura*, which totally lacks the spinous areas characteristic of *Rhinomorinia* and *Melanomyoides* (and also *Phyto*).

Apart from the surstylus shape, *Melanomyoides* differs from *Rhinomorinia* in the petiolation of cell R_5, in the lack of any trace of pale pollinose vittae on the mesonotum, in the reduced palpi, and in the possession of only one *av* seta on the hind tibia (sometimes a minute *av* setula in addition). It differs from all *Rhinomorinia* species except *R. capensis* (Brauer & Bergenstamm) and *R. approximata* sp. n. in lacking prevertical setae in the male, and from all *Rhinomorinia* species except the Nepalese *R. longifacies* Herting in having the lateral scutellar setae inserted much nearer to the scutellar base than to the apical scutellar setae. Some of these distinctions from *Rhinomorinia* are, of course, not very tangible and despite the male genitalic difference from *Rhinomorinia* and the close superficial resemblances to *Melanomya* and *Angioneura*, I think it likely that *Melanomyoides* is phyletically very close to *Rhinomorinia*. (Nomenclaturally, it should be noted, *capensis* Zumpt will be a junior homonym of *capensis* Brauer & Bergenstamm, if *Melanomyoides* and *Rhinomorinia* should be merged, and will then require a new name.)

Melanomyoides capensis (Zumpt) **comb. n.**

Chaetostevenia capensis Zumpt, 1959 : 433. Holotype ♂, South Africa (UZI, Lund) [examined].

Description. ♂. Head ground colour black, occipital regions shining and non-pollinose, parafacials thickly silvery white pollinose, face thinly yellowish brown pollinose; antennae black, palpi blackish brown. Head as Fig. 12, upper occiput flat. Eyes extremely strongly approximated and frons very reduced, frons at narrowest point about twice as wide as anterior ocellus and narrower than third antennal segment, about 0·065 of head-width (but interfrontal area distinct on whole height of frons and para-

frontals *not* meeting despite extreme approximation of the eyes). Proclinate orbital setae absent. Prevertical setae absent, outer vertical setae present but small. Parafacial at mid point about half as wide as third antennal segment. Upper occiput bare behind the postocular row. Third antennal segment about 1·9 times as long as second. Palpi small, shorter than third antennal segment. Thorax shining black with thick silver white pollinosity on humeral calli (no trace of vittae); pleural regions with very inconspicuous thin yellowish brown pollinosity. Two humeral setae. Two or three *stpl* setae. Infrasquamal hairs absent or in a small tuft. Legs black; claws very long. Fore tibia without *pd* setae. Mid femur with some inconspicuous setulae on the *a* surface amongst the normal hair. Hind tibia normally with one *av* seta but sometimes accompanied by a second small setula. Wings nearly hyaline; basicosta blackish brown; halteres yellow. Wing venation as Fig. 9. Spinules of first costal sector numerous and not enlarged. Calyptrae yellowish white. Abdomen black and rather shining, with diffuse pollinosity, the pollinosity whitish and moderately conspicuous laterally on T3 and T4 but more greyish or brownish and rather inconspicuous medially on these tergites and on T5. Abdominal T3 without median marginal setae (but with rather long marginal hairs); intermediate tergites with short erect hairing; T7+8 with a pair of long strong setae (visible in situ), epandrium small and inconspicuous in situ. Cerci and surstyli as Fig. 33. Measurements: body length 3·3–3·7 mm, wing length 3·0–3·4 mm [6 specimens].

♀. Similar to ♂ but with widely separated eyes, the frons 0·33 of head-width and with one or two pairs of proclinate orbital setae; parafrontals shining black on uppermost two-thirds and silvery white pollinose on lowermost thirds (the pollinosity continuous with that of the parafacials). Abdomen unicolorous shining black without pollinosity. Measurements: body length 2·7–3·1, wing length 2·6–2·7 mm [only 3 specimens seen, perhaps unusually small].

MATERIAL EXAMINED. Holotype ♂, SOUTH AFRICA: Cape Province, Cape Peninsula, Hout Bay, Skoorsteenkop, 2.ii.1951 (*Brinck & Rudebeck*), in Universitetets Zoologiska Institution, Lund. (The holotype is gummed to a card mount, has lost both mid legs, the tip of the left hind tarsus and the right third antennal segment, and the genitalia are separately slide-mounted. The genitalia slide has the aedeagus, ejaculatory sclerite and cerci and surstyli disconnected, the cerci and surstyli being flattened out from behind as in Zumpt's figure.)

SOUTH AFRICA: 8 ♂, 3 ♀, Cape Province, Cape Peninsula, Silvermine nature reserve, 2–3.i.1972 (*B. H. Cogan*) (BMNH, except one ♂ and one ♀ in NMP).

NOTE ON THE TYPE-MATERIAL. Zumpt's (1959 : 433) description mentions '2 ♂♂, 8 ♀♀', all with the same locality but with collecting date range 22.i–18.ii.1951, and does not mention any particular specimen as type. But Zumpt (*op. cit.*: 427) refers to the 'holotypes' in the introduction to his paper, stating that they are in Lund, and because of this statement and the fact that one of the males bears a holotype label it is considered that *capensis* was originally based on a holotype (even though all specimens appear to have the status of syntypes if only the original description on p. 433 is considered). The Lund collection contains, with the holotype, five ♀ paratypes. Presumably the remaining four paratypes (♂ and three ♀) were retained by Zumpt. None of the paratypes has been seen, but all are certainly conspecific with the holotype.

Genus ***RHINOMORINIA*** Brauer & Bergenstamm

Rhinomorinia Brauer & Bergenstamm, 1889 : 123 (55). Type-species: *Morinia sarcophagina* Schiner, 1862, by monotypy.

Oxytachina Brauer & Bergenstamm, 1891 : 369 (65). Type-species: *Oxytachina vittata* Brauer & Bergenstamm, 1891, by monotypy. **Syn. n.** [The only included species cited as '*vittata* Wd.' but this specific name not published by Wiedemann and attributable to Brauer & Bergenstamm. Situation considered not to be exact equivalent of 'gen. n., sp. n.' under the terms of I.C.Z.N. Code Article 68 (a) (i) and *vittata* therefore cited as fixed by monotypy and not original designation.]

Pseudophania Brauer & Bergenstamm, 1893 : 139 (51). Type-species: *Pseudophania capensis* Brauer & Bergenstamm, 1893, by original designation. **Syn. n.** [The only included species name attributable to Brauer & Bergenstamm and based on Schiner manuscript name 'Besseria capensis'. Genus explicitly proposed by Brauer & Bergenstamm 'für' *capensis* and type-species therefore fixed by original designation.]

Dewetia Bischof, 1904 : 95. Type-species: *Dewetia atra* Bischof, 1904, by monotypy. **Syn. n.**

DIAGNOSIS. Head shape as Figs 8–10 or similar. Eyes narrowly to broadly suboval or almost subcircular in outline, slightly to strongly oblique; gena of moderate size, its depth slightly to much greater than antennal width. Epistome moderately to strongly warped forwards from the face, facial profile conspicuously concave. Vibrissal angles strongly developed, from slightly less to slightly more prominent than the profrons; vibrissae inserted below lowermost point of the eye but much above lowermost point of the head (head in profile with a rather strong anteroventral angulation). Eyes of ♂ widely separated or approximated. ♂ with or without proclinate orbital setae, with prevertical setae (except in *approximata* and *capensis*), with or without outer vertical setae. Parafacials well visible in profile (narrowly in *setitibia*), usually haired at least at extreme upper ends. Antennae small or medium-sized, falling short of epistome, antennal axis usually about level with eye middle; arista pubescent or bare. Proboscis usually short (long in *vittata*, Fig. 9). Pre-alar seta weak or absent [except, according to Herting (1961), in *subrostrata* Villeneuve, not seen]. Presutural *acr* setae almost always differentiated as at least one pair. Lower prostigmatic seta variable, often rather strong and slightly proclinate. Pteropleural seta usually rather long and fine (about as long as notopleurals), sometimes hair-like. Barette bare (rarely an adventitious hair). Apical scutellar setae variable, hair-like to extremely strong; lateral scutellar setae inserted equidistantly between scutellar base and apical setae (except nearer base in *longifacies* Herting from Nepal). Mid tibia with one or two *ad* setae. Hind tibia with two or more *ad* setae, with two *av* setae (exceptionally only one), and a *pv* apical seta. Wing cell R_5 open or closed in wing margin (with *very* short petiole half as long as *r–m* in *setitibia* and trace of petiole in *capensis*); bend of vein *M* widely obtuse, gently rounded or at most only very slightly abrupt; *m–cu* straight or slightly sinuous, at right-angles to or oblique to vein *M*; basal node of R_{4+5} with one strong or very strong setula, often accompanied by one or two hairs; costal spine well developed (sometimes as much as three times as long as *r–m*). Abdomen with or without discal setae; abdominal T1 + 2 without median marginal setae. ♂ cerci and surstyli narrow and usually very elongate, often borne on much enlarged epandrium; ejaculatory sclerite small or medium-sized, narrowly spatulate or fan-shaped.

DISTRIBUTION. Palaearctic Region, Oriental Region (Nepal) and southern Afrotropical Region. Occurring widely in Europe but absent from Scandinavia and British islands; apparently unknown from North Africa and Atlantic islands.

DISCUSSION. At the time of Herting's (1961) account of the Palaearctic fauna only two species were placed in *Rhinomorinia*, both being European, but a Nepalese species was later described by Herting (1966), and I am now assigning to the genus a further nine species from southern Africa (four of which were previously described and five of which are new). The new placement of African forms into the genus widens the generic concept to some extent and requires brief discussion.

Brauer & Bergenstamm (1891; 1893) described the genera *Oxytachina* and *Pseudophania*, and Bischof (1904) described the genus *Dewetia*, each of these genera being monotypic for species from South Africa (viz. *O. vittata*, *P. capensis* and *D. atra* respectively). Up to now these nominal genera have been virtually ignored by dipterists (the types being in Vienna and African rhinophoroids being so little investigated) but Townsend (1935; 1938) placed all three as valid in his Melanophorini, and Villeneuve (1918) briefly alluded to the close affinity of *Pseudophania* and *Dewetia* to the European genus *Rhinomorinia*; evidently Villeneuve had observed the obvious resemblance of *Dewetia* and *Pseudophania* to each other, and of both to *Rhinomorinia*, even though he did not establish formal synonymy of the names. In the present work I treat both *Dewetia* and *Pseudophania* as synonymous with *Rhinomorinia*, having been unable from a critical comparison of the type-species to discover any character or set of characters that justifies their separation. *Oxytachina* was not seen, or at any time discussed, by Villeneuve, but this nominal genus, too, I synonymize with *Rhinomorinia*: it is known only from the female holotype of *O. vittata*, which on first glance appears rather different from *Rhinomorinia* (because of its elongate proboscis and strongly vittate thorax), but which in fact possesses all the essential characters of *Rhinomorinia* and which in my opinion cannot legitimately be distinguished from it at the generic level. Zumpt (1959), it may be noted, did not deal with *Oxytachina*, but he did synonymize *Dewetia atra* with *Pseudophania capensis*, an action that thereby synonymizes *Dewetia* with *Pseudophania* even though Zumpt did not state so.

Apposite here to the question of generic limits is the generic position of the most common South African rhinophorid, the species described as *Hoplisa xanthocephala* by Bezzi (1908) and

later as *Hoplisa novicia* by Villeneuve (1916) (for new synonymy of these names see under the species treatment for *xanthocephala*). This species is very distinctive because of its largely yellow head, extremely prominent epistome, grey vittate thorax and exceptionally strong costal spine and costal spinules, and looks very different from the shining black *Rhinomorinia* species such as the European type-species, *R. sarcophagina* (Schiner) and South African species such as *R. atra* and *R. capensis* (type-species of *Dewetia* and *Pseudophania* respectively). On the other hand, its head shape, head vestiture and very strong wing-node bristle are very reminiscent of the European genus *Oplisa* (= *Hoplisa*, emendation), and it is not surprising that Bezzi and Villeneuve both described the species in *Oplisa*.

The genera *Rhinomorinia* and *Oplisa* are extremely similar and I was at first inclined to widen the concept of *Oplisa* (the name dating from Rondani, 1862) so as to include *Rhinomorinia* (and its synonyms *Oxytachina*, *Pseudophania* and *Dewetia*) within it, a course that seemed justified by the close structural and chaetotactic resemblance between some species of *Rhinomorinia* (especially *xanthocephala*) and *Oplisa tergestina* (Schiner), the type-species of *Oplisa*. This course has been contra-indicated, however, by examination of the male hypopygium, as detailed below.

The genus *Oplisa* contains, according to Herting (1961), three western Palaearctic species and is not known outside of Europe and North Africa (*xanthocephala* being here placed in *Rhinomorinia*). One of the three species, *oldenbergi*, was described by Herting (1961) and placed by him in a new subgenus of *Oplisa*, namely *Anoplisa*, this species (not seen) being known only from the male holotype and differing from the other two species in having proclinate (i.e. normal) ocellar setae. The other two species, *tergestina* and *aterrima* (Strobl), constituting *Oplisa* s. str. in Herting's treatment, have the ocellar setae reclinate or at least directed straight outwards, and in this character differ from all *Rhinomorinia* species and (to the best of my knowledge) from all other rhinophorids. The male genitalia of *tergestina* and *aterrima* have been examined and found to be virtually identical with each other, but to differ from *Rhinomorinia* species (and from all other Rhinophoridae for which I have examined the male hypopygium) by the possession of a quite extraordinary ejaculatory sclerite. This structure throughout the calyptrate flies is typically quite small or of moderate size and its shape rod-like, clove-like or spatulate and fan-like, but in *Oplisa tergestina* and *O. aterrima* it takes the form of an enormous ovate or leaf-like plate articulated to a small strongly sclerotized incomplete ring and extending far forwards into the abdomen (Fig. 40). This feature, taken together with the reclinate ocellar setae, makes *Oplisa* s. str. unique, and disinclines me to widen the concept of the genus so as to incorporate *Rhinomorinia* within it. I therefore maintain *Rhinomorinia* as a distinct genus from *Oplisa*, whilst considering that they are probably close affines phyletically.

Key to Afrotropical species of *Rhinomorinia* Brauer & Bergenstamm

Males

[*Note*. The males of *scutellata* and *vittata* are unknown.]

1 Prevertical setae absent 2
– Prevertical setae present 3
2 Eyes extremely strongly approximated, frons at narrowest point 0·08 of head-width (narrower than third antennal segment). Thoracic dorsum with the silver vittae confined to the prescutum (stopping abruptly at the transverse suture). Costal spine conspicuously shorter than second costal sector . . . . **R. approximata** sp. n. (p. 29)
– Eyes much less strongly approximated, frons at narrowest point about 0·18 of head-width (much wider than third antennal segment). Thoracic dorsum with the submedian silver vittae not completely confined to the prescutum (when seen in some lights conspicuously extending on to the scutum and from some viewpoints faintly evident back to the scutellum). Costal spine as long as the second costal sector . . . **R. capensis** (Brauer & Bergenstamm) (p. 30)
3 Interfrontal area unicolorous orange-yellow, or reddish orange anteriorly and dark reddish brown posteriorly. Apical scutellar setae weak or hair-like (not more than half as long as lateral setae). Thoracic dorsum with the paired silvery or grey pollinose vittae complete (well developed on scutum as well as prescutum and reaching scutellum). Mid femur with a row of several setae on the *a* surface 4

– Interfrontal area black. Apical scutellar setae strong (as large as, or not much smaller than, the lateral setae). Thoracic dorsum with the paired silvery or grey pollinose vittae incomplete (absent or evanescent on scutum or only partially evident from certain directions, sometimes also weakly defined on prescutum). Mid femur with not more than two definite setae on the *a* surface 5

4 Interfrontal area orange-yellow. One pair of proclinate orbital setae. Outer vertical setae present. Abdominal T3 with long erect median marginal setae, T4 with a pair of small fine erect discal setae. Mid tibia with two *ad* setae . . . . . ***R. xanthocephala*** (Bezzi) (p. 35)

– Interfrontal area reddish orange anteriorly and dark reddish brown posteriorly. Two pairs of proclinate orbital setae. Outer vertical setae absent. Abdominal T3 without median marginal setae, T4 without discal setae. Mid tibia with one *ad* seta . . . . . ***R. bisetosa*** sp. n. (p. 35)

5 Abdominal T3 with a pair of strong erect median marginal setae, T4 (and sometimes also T3) with median discal setae. Upper occiput bare behind the postocular row. Outer vertical setae absent. Frons not more than 0·27 of head-width. Abdomen with conspicuous fasciae of silvery white pollinosity basally on T3, T4 and T5 (the fasciae incomplete medially) . . 6

– Abdominal T3 without median marginal setae, both intermediate tergites without discal setae. Upper occiput with strong black setulae behind the postocular row. Outer vertical setae present. Frons wider, about 0·32 of head-width. Abdomen with rather diffuse greyish pollinosity . . . . ***R. verticalis*** sp. n. (p. 33)

6 Fore tibia without *pd* setae. Frons without proclinate orbital setae. Parafacials broad, at mid point nearly as wide as third antennal segment. Abdominal T3 without discal setae. Arista conspicuously pubescent. Wing with cell R_5 closed at or just before the margin ***R. atra*** (Bischof) (p. 31)

– Fore tibia with a submedian *pd* seta and a preapical *pd* seta. Frons with one pair of proclinate orbital setae. Parafacials narrow, at mid point hardly half as wide as third antennal segment. Abdominal T3 (as well as T4) with strong erect discal setae. Arista bare. Wing with cell R_5 short-petiolate (the petiole about as long as *r–m*) . . . . ***R. setitibia*** sp. n. (p. 32)

Females

1 Head with one pair of proclinate orbital setae 2

– Head with two pairs of proclinate orbital setae 5

2 Interfrontal area orange-yellow. Apical scutellar setae very weak or hair-like (much less than half as long as lateral setae). Thoracic dorsum with a pair of conspicuous broad ashy grey vittae, complete on whole length of prescutum and scutum. Head with outer vertical setae *and* abdomen with median marginal setae on T3 . . . . ***R. xanthocephala*** (Bezzi) (p. 35)

– Interfrontal area black or dark reddish brown. Apical scutellar setae moderately to very strong (at least half as long as lateral setae and usually almost as large). Thoracic dorsum with pale vittae incomplete, absent on scutum or only partially developed and just detectable in certain lights. Outer vertical setae and median marginal setae of T3 not present simultaneously . 3

3 Abdominal T3 without median marginal setae and T4 without discal setae. Fore tibia without *pd* setae. Upper occiput with black setulae behind the postocular row 4

– Abdominal T3 with strong erect median marginal setae and T4 with median discal setae. Fore tibia with a submedian *pd* seta and a preapical *pd* seta. Upper occiput without setulae behind the postocular row . . . . ***R. setitibia*** sp. n. (p. 32)

4 Outer vertical setae present. Apical scutellar setae about as large as the lateral setae. Mid tibia with one *ad* seta. Interfrontal area black . . . . ***R. verticalis*** sp. n. (p. 33)

– Outer vertical setae absent. Apical scutellar setae about half as long as the lateral setae. Mid tibia with two *ad* setae. Interfrontal area dark reddish brown . . ***R. scutellata*** sp. n. (p. 34)

5 Abdominal T4 without discal setae. Thoracic dorsum with complete and conspicuous broad silvery or grey vittae (well developed on both prescutum and scutum). Upper occiput with black setulae behind the postocular row. Mid femur with a row of several setae on the *a* surface 6

– Abdominal T4 with erect discal setae. Thoracic dorsum with incomplete silvery or grey vittae (these absent or weakly differentiated and discernible only at certain angles on the scutum, distinct only on the prescutum). Upper occiput bare behind the postocular row. Mid femur with not more than two definite setae on the *a* surface 7

6 Abdominal T3 with a pair of strong erect median marginal setae. Interfrontal area blackish. Scutellum with thick pale yellowish grey pollinosity on the middle two-thirds, black only at the sides. Proboscis long and slender (the length exceeding the head height, Fig. 9). Outer vertical setae present . . . . ***R. vittata*** (Brauer & Bergenstamm) (p. 38)

– Abdominal T3 without median marginal setae. Interfrontal area orange-red anteriorly and dark reddish brown posteriorly. Scutellum unicolorous shining black. Proboscis not elongate (shorter than height of the head). Outer vertical setae absent . . . ***R. bisetosa*** sp. n. (p. 35)

7 Abdominal T5 unicolorous shining black. Costal spine less than twice as long as *r–m* and shorter than second costal sector

? ***R. approximata*** sp. n. or ***R. capensis*** (Brauer & Bergenstamm)* (p. 30)

– Abdominal T5 with bright silvery white pollinosity on the basal half. Costal spine stronger, twice as long as *r–m* and subequal in length to second costal sector . ***R. atra*** (Bischof) (p. 31)

* The ♀ paralectotype of *capensis* runs out here. It is probable that it is misassociated with the lectotype and actually a specimen of *R. approximata*.

Rhinomorinia approximata sp. n.

Description. ♂. Head ground colour black except for dark reddish brown subparafacial areas, upper occiput rather shining; parafrontals and parafacials thickly silvery white pollinose, genae and postbuccae also conspicuously white pollinose when seen from above, vertex without evident pale pollinosity behind the ocellar triangle; antennae black; palpi tawny yellowish with darker tips. Head higher than long, eye profile suboval and oblique, epistome moderately strongly warped forwards from the face and about as prominent as the profrons, upper occiput flat. Eyes unusually strongly approximated [specific name alluding to this character], frons very reduced and at narrowest point above 0·08 of head-width (not as wide as third antennal segment); parafrontals exceedingly narrow on upper parts but not actually meeting in mid-line despite frontal reduction, the interfrontal area differentiated on its whole height. Proclinate orbital setae absent. Prevertical setae absent. Outer vertical setae absent and inner vertical setae unusually short (about as long as antennae). Parafacials moderately broad, at mid point about two-thirds as wide as antennae, bare except for a very few tiny hairs at extreme upper ends. Upper occiput bare behind postocular row. Antennae medium-sized, third segment about 1·9 times as long as second segment; arista pubescent. Proboscis short. Thorax shining black with thick silvery white pollinosity over humeral calli and notopleura and on a pair of broad close-set submedian prescutal vittae (silvery vittae stopping abruptly at transverse suture and not continuing on to scutum when seen from any angle); pleural regions thinly white pollinose. Two humeral setae. 1 + 1 *acr* setae. Two *stpl* setae (plus a straight strong hair in position of lower anterior *stpl* seta). Pteropleural seta weakly differentiated. Infrasquamal hairs conspicuous. Scutellum with very strong apical setae (slightly shorter than laterals), basal setae represented by strong hairs, lateral setae inserted about equidistantly between scutellar base and apical setae. Legs black; claws long. Fore tibia without *pd* setae. Mid femur without setae on the *a* surface. Mid tibia with one *ad* seta. Hind tibia with two *ad* setae and two *av* setae. Wings almost hyaline; basicosta orange-yellow; halteres yellow. Cell R_5 closed exactly at wing margin; *m–cu* very slightly oblique in relation to *M* and about mid-way between *r–m* and the bend, angled inwards near the middle; costal spine well developed but not unusually strong, distinctly shorter than second costal segment; costal spinules numerous and not obviously enlarged; basal node of R_{4+5} with one very long strong setula accompanied by one or two small hairs. Calyptrae pale yellowish. Abdomen shining black with conspicuous basal bands of silvery white pollinosity on T3, T4 and T5, the pollinose bands interrupted medially (especially on intermediate tergites) (pale pollinosity about a third or two-fifths of length of intermediate tergites dorsally and about half length of these tergites laterally). Abdominal T3 with a pair of very strong erect median marginal setae and without discal setae; T4 with a pair of strong erect median discal setae; both intermediate tergites with rather strong sparse recumbent hairing. T7 + 8 forming a shining knob visible in situ below and behind T5 and epandrium enlarged, both epandrium and T7 + 8 with very strong setae. Cerci extremely long and extremely narrow. Measurements: body length 5·0 mm, wing length 4·5 mm [1 specimen].

♀. Unknown [but ♀ paralectotype of *capensis* might be this species].

Material examined. Holotype ♂, South Africa: Cape Province, Patensie District, Cambria area, Wit River valley, 3324DA, 6.xii.1967 (*B. & P. Stuckenberg*), in Natal Museum, Pietermaritzburg.

Affinities. This new species is known only from the male holotype, which although superficially similar to *R. atra* and *R. capensis* differs from these (and all other Afrotropical *Rhinomorinia* species) in having extremely strongly approximated eyes. The frons is much reduced and proclinate orbital and prevertical setae are lost. Apart from the head there is very little difference between *approximata* and *atra* and *capensis*, and *approximata* is unquestionably phyletically very close to these species (*approximata* representing a more apomorphic stage from these species towards

the fully holoptic male head condition with its associated loss of orbital and prevertical bristles). From *atra* the new species is easily differentiated by absence of prevertical setae and from *capensis* by the afore-mentioned much narrowed frons; from both these species *approximata* differs by having a smaller costal spine (that is obviously shorter than the second costal segment) and by having the submedian silver vittae of the thorax stopping abruptly at the transverse suture (i.e. with no trace of extension posteriorly on to the scutum). *R. approximata* differs from *R. setitibia* (a fourth species forming a natural group with *approximata*, *capensis* and *atra*) by the narrow frons, lack of proclinate orbital and prevertical setae, and lack of posterodorsal setae on the fore tibia.

The ♀ paralectotype of *capensis* (which differs from the females of *atra* and *setitibia* by having the fifth abdominal tergite uniformly shining black instead of pale-banded) might be mis-associated with the lectotype, and could perhaps be a specimen of *approximata*.

Rhinomorinia capensis (Brauer & Bergenstamm) **comb. n.**

Pseudophania capensis Brauer & Bergenstamm, 1893 : 139 (51) ('*Besseria capensis* Schiner' MS name); Villeneuve, 1918 : 504; Townsend, 1931 : 383; Townsend, 1935 : 251; Townsend, 1938 : 201; Zumpt, 1959 : 434. Lectotype ♂ (by fixation as 'type' by Villeneuve, 1918 : 504), SOUTH AFRICA (NM, Vienna) [examined].

DESCRIPTION. ♂. Extremely similar to *R. atra* described below and only differing as follows. Head without trace of prevertical setae. Frons slightly but distinctly narrower than in *atra*, at narrowest point about 0·18 of head-width. Cell R_5 with a *very* short petiole (about two-fifths as long as *r–m*). Measurements: body length 4·3 mm, wing length 3·7 mm.

[♀. Not certainly known, paralectotype ♀ possibly misassociated with ♂ lectotype. Paralectotype differing from *atra* in having the whole of abdominal T5 metallic (no trace of white pollinose band) and from lectotype in having cell R_5 closed at wing edge without trace of petiole. Measurements: body length 5·1 mm, wing length 4·4 mm.]

MATERIAL EXAMINED. Lectotype ♂, SOUTH AFRICA: Cape Province, Cape of Good Hope, in Naturhistorisches Museum, Vienna (coll. Winthem).

Paralectotype. 1 ♀ [presumed correctly associated with lectotype], data and depository as for lectotype.

TYPE-MATERIAL AND STATUS. There is some confusion over the type-material, its whereabouts and status that needs clearing up. At the start of this revision Dr Lichtenberg kindly sent to me from the Vienna collection two specimens standing under the name *Pseudophania capensis* that appeared to be the entire type-series (Brauer & Bergenstamm did not state the number of type specimens before them but their description makes clear that there must have been at least two specimens because both sexes are mentioned). The specimens received from Vienna comprised one ♂ and one ♀, and it was at first assumed that this was the entire type-series. Examination of the ♂ specimen, however, showed that it had a very broad frons possessing both strong proclinate orbital setae and strong prevertical setae, whereas the original description makes it clear by implication that the male of *capensis* should lack proclinate orbital setae (as it is stated for female 'setae orbitales tantum in femina duae'). Furthermore, Townsend's (1938) characterization for the genus *Pseudophania* (type-species *capensis*), based on his examination of types, states '2 PFRO in female and none in male', again meaning that the male lacks proclinate orbital setae. And Villeneuve (1918) also had implied the lack of proclinate orbitals in the ♂ 'type' of *capensis* that he cited, because he compared it with the type of *atra* (which also lacks proclinate orbital setae in the male) and noted that the two species types differed by presence and absence of the *prevertical* seta (i.e. the 'soie frontale postérieure tournée en dehors'), not by the proclinate orbital setae. Thus it was evident that the ♂ specimen cited as 'type' by Villeneuve (1918) and as 'Ht' (i.e. holotype) by Townsend (1931; 1938) could not be the ♂ specimen now standing in the Vienna collection, but that both Villeneuve and Townsend had clearly seen an original ♂ syntype agreeing with Brauer & Bertenstamm's description in lacking proclinate orbital setae.

Thus the true ♂ type was missing from Vienna, and the specimen that could now be found there of this sex had no type-status. It seemed possible that Townsend might have borrowed the

♂ syntype from Vienna many years ago and inadvertently not returned it, and enquiry of Dr Sabrosky at the USNM, Washington, D.C., confirmed that the missing ♂ syntype was indeed present in Townsend's 'genotype' collection at USNM. The specimen is from the von Winthem collection in Vienna (being so labelled), and is undoubtedly the original ♂ syntype on which Brauer & Bergenstamm's description is partially based, and is also without doubt the ♂ 'type' and 'Ht' cited by Villeneuve and Townsend. The specimen has been seen (on loan from USNM) and its return to Vienna is being arranged: for purposes of this paper the specimen is cited as in NM, Vienna.

The status of the specimen is accepted as that of lectotype by fixation of Villeneuve (1918). It could be maintained that neither Villeneuve nor Townsend had provided a valid fixation of the ♂ without proclinate orbital setae as lectotype, since their statements were rather brief and imprecise, but I see no value in setting aside earlier statements in this case and treat Villeneuve's citation of the ♂ 'type' as being a valid lectotype fixation (the statement can refer only to one specimen and there is no real doubt about which specimen is meant). To designate here the same specimen as a new lectotype designation would serve no purpose.

Finally here it should be noticed that Zumpt (1959 : 434), writing of *atra* and *capensis*, refers to having seen 'the types of both species', but it was the ♀ syntype of *capensis* (i.e. paralectotype) that Zumpt saw.

AFFINITIES. *R. capensis* is exceedingly closely allied to *R. atra* and Zumpt (1959) actually synonymized the names. Zumpt's action however was based on a comparison of the female of *capensis* with the *atra* male holotype, and I do not accept the synonymy here. It is notable, too, that neither Villeneuve nor Townsend (both of whom saw the ♂ primary types of the two names) established such synonymy. Nevertheless it is just possible that the holotype of *atra* and the lectotype of *capensis* are conspecific because the differences between them seem to consist only of head features (and the head of the *capensis* lectotype might be aberrant). In *capensis* there are no prevertical setae in the ♂, whereas these are very strong in *atra*, and *capensis* has the frons slightly narrower (about 0·18 of head-width as against about 0·22 in *atra*). The females show a difference in the last abdominal tergite, that of *capensis* being all shining black and that of *atra* having a pale pollinose basal band like that on the preceding tergites (it is not certain, however, that the ♀ paralectotype of *capensis* is rightly associated, and it might be a specimen of *approximata*).

Rhinomorinia atra (Bischof) **comb. n.**

Dewetia atra Bischof, 1904 : 97; Villeneuve, 1918 : 504; Townsend, 1931 : 383; Townsend, 1935: 251; Townsend, 1938 : 189; Zumpt, 1959 : 434. Holotype ♂, SOUTH AFRICA (NM, Vienna) [examined].

DESCRIPTION. ♂. Head ground colour black, interfrontal area sometimes very dark brown, subparafacials dark reddish brown, upper occiput rather shining black; parafrontals and parafacials thickly silvery white pollinose, vertex ashy grey pollinose on either side of posterior part of ocellar triangle; antennae black; palpi tawny yellow. Head higher than long, eye profile suboval and weakly oblique, epistome not very strongly warped forwards from face but about as prominent as profrons, upper occiput flat. Eyes hardly at all approximated, frons at narrowest about 0·225 of head-width. Proclinate orbital setae absent. Prevertical setae present (strong and directed conspicuously outwards), outer vertical setae absent. Parafacials moderately broad, nearly as wide as third antennal segment, bare or with a very few inconspicuous hairs at extreme upper end. Upper occiput bare behind the postocular row. Antennae medium-sized, third segment falling short of epistome and about 1·7 times as long as second segment; arista pubescent. Proboscis short. Thorax black with a pair of submedian silvery white vittae on the prescutum and thick white pollinosity on humeral calli and notopleura; scutum with traces of pale greyish pollinose vittae continuous with those on prescutum, scutal vittae hardly evident on mid part of scutum but distinct in certain lights just before the scutellum; pleural regions thinly white pollinose. Two humeral setae. 1(+)+1 *acr* setae. Two or three *stpl* setae. Pteropleural seta well developed but very fine. Infrasquamal hairs few, minute and very inconspicuous, occasionally absent. Scutellum with strong apical setae (but distinctly shorter than laterals), lateral setae inserted equidistantly between scutellar base and apical setae, basal setae absent. Legs black; claws rather long, especially fore claws conspicuously long and fine. Fore tibia without submedian *pd* seta, without or with very weak preapical *pd* seta. Mid femur usually with one

or two setae on the *a* surface, occasionally without. Mid tibia with one or two *ad* setae (usually two). Hind tibia with two *ad* setae and two *av* setae. Wings hyaline or very faintly brownish; basicosta pale yellow; halteres yellow. Cell R_5 closed at the wing margin or just open; *m–cu* about at right-angles to *M* and about mid-way between *r–m* and the bend; costal spine very strong, equal in length to second costal sector and twice as long as *r–m*; costal spinules numerous and not very conspicuously enlarged; basal node of R_{4+5} with a strong setula and additional hair or two. Calyptrae pale yellow, colour less intense medially than elsewhere. Abdomen black with basal bands of silvery or greyish white pollinosity on T3–T5, the bands interrupted medially and less extensive on the dorsum than on the sides (pale pollinosity about a quarter to a third of length of intermediate tergites dorsally and over half length of these tergites laterally). Abdominal T3 with a pair of very strong erect median marginal setae and without discal setae; T4 with a pair of strong erect median discal setae; both intermediate tergites with long recumbent hairing. T7+8 forming a shining protuberant knob well visible in situ under T5 and the epandrium slightly enlarged, both epandrium and T7+8 with strong setae. Cerci and surstyli extremely slender and attenuate, subequal in length. Measurements: body length 4·2–5·5 mm (mean 4·7), wing length 3·5–4·5 mm (mean 4·0) [6 specimens].

♀. Extremely similar to ♂ but differing in wider frons (0·32 of head-width) and in having two pairs of proclinate orbital setae. Abdominal T5 rather strongly compressed into a vertical apical keel. Measurements: body length 4·6–5·6 mm (mean 5·0), wing length 4·0–4·5 mm (mean 4·2) [9 specimens].

MATERIAL EXAMINED. Holotype ♂, SOUTH AFRICA: Cape Province, Algoa Bay (=Algoabaai), 22.xi.1896 (*Brauns*), in Naturhistorisches Museum, Vienna. (The holotype is teneral and greasy, has lost the right mid and hind legs from the trochanters, lacks the left hind tarsus, and has the claws broken off.)

SOUTH AFRICA: 1 ♂, Cape Province, Port Elizabeth District, van Staadens Pass, 30.x.1964 (*B. & P. Stuckenberg*) (NMP); 3 ♂, Cape Province, Port Elizabeth, 29.x.1931 (*Miss A. Mackie*) (BMNH); 1 ♂, Cape Province, South West District (BMNH); 3 ♂, 7 ♀, Cape Province, Cape of Good Hope nature reserve, 7–10.iii.1968 (*P. Spangler*) (2 ♂, 6 ♀ USNM & 1 ♂, 1 ♀ BMNH); 2 ♀, Cape Province, Hout Bay, Skoorsteenkop, 18.xi.1951 (*Brinck & Rudebeck*) (BMNH); 1 ♀, Cape Province, Cape Point, 30.x.1954 (*C. H. Andrewes*) (BMNH).

AFFINITIES. *Rhinomorinia atra* is very closely allied to *R. capensis*, differing only by the features mentioned in the key. From *R. approximata* it differs by the much wider frons in the male and presence of prevertical setae, and from *R. setitibia* (to which it is certainly very close) it differs by lacking proclinate orbital setae in the male and by the absence of *pd* setae on the fore tibia.

Rhinomorinia setitibia sp. n.

DESCRIPTION. ♂. Head ground colour black, except for subparafacials dark reddish brown, parafrontals and parafacials silvery grey pollinose, vertex yellowish grey pollinose on either side of the posterior part of the ocellar triangle; antennae black (with very slight trace of orange colour at junction of second and third segments); palpi yellow apically, darker yellowish brown or brown basally. Head higher than long, eye profile suboval and weakly oblique, epistome not very strongly warped forwards from face but nearly as prominent as profrons, upper occiput flat. Eyes very slightly approximated, frons at narrowest about 0·27 of head-width. One pair of strong proclinate orbital setae (standing almost in line between the uppermost frontal setae and the prevertical setae). Prevertical setae present (strong and rather reclinate), outer vertical setae absent. Parafacials very narrow, at mid point less than half as wide as third antennal segment, with a very few hairs at extreme upper ends. Upper occiput bare behind the postocular row. Antennae medium-sized, third segment falling well short of epistome and about 2·2 times as long as second segment; arista bare. Proboscis short. Thorax black with a pair of submedian silvery grey vittae on the prescutum, thick whitish pollinosity on humeral calli and notopleura, and thin whitish pollinosity on pleural regions. Two humeral setae. 1(+)+1 *acr* setae. Two *stpl* setae. Pteropleural seta well developed, slightly longer than notopleural setae. Infrasquamal hairs absent. Scutellum with strong apical setae (nearly as long as laterals), lateral setae inserted equidistantly between scutellar base and apical setae, *very* weak basal setae just differentiated. Legs black; claws moderately long. Fore tibia with a submedian *pd* seta and a preapical *pd* seta. Mid femur with two differentiated setae on the *a* surface. Mid tibia with two *ad* setae. Hind tibia with two *ad* setae and two *av* setae. Wings very faintly tinged yellowish brown; basicosta yellow; halteres yellow. Cell R_5 closed and with a small petiole about equal in length to *r–m*; *m–cu* at right angles to *M* but bent outwards medially so that the proximal angle formed with Cu_1 is conspicuously acute, *m–cu* meeting

M conspicuously nearer to *r–m* than to the bend; costal spine extremely strong, longer than second costal sector and about three times as long as *r–m*; costal spinules numerous and only very inconspicuously enlarged; basal node of R_{4+5} with one very large or enormous setula, with or without additional hair. Calyptrae white or yellowish. Abdomen black with narrow basal bands of white pollinosity on T3–T5, the pale pollinose bands interrupted medially on the intermediate tergites. Abdominal T3 with a pair of very strong erect median marginal setae; intermediate tergites each with one pair of strong erect median discal setae, and with recumbent hairing. T7 + 8 forming a shining protuberant knob projecting medially under T5 and epandrium very large, both T7 + 8 and epandrium with short strong setae. Cerci and surstyli long and narrow. Measurements: body length 4·0 mm, wing length 3·4 mm [2 specimens].

♀. Extremely similar to ♂ but differing by wider frons (0·32 of head-width) and in having abdominal T5 entirely shining black without pollinose band. One *av* seta on hind tibia and no discal setae on abdominal T3 in the one specimen seen but these features perhaps not constant.

MATERIAL EXAMINED. Holotype ♂, SOUTH AFRICA: Natal, Hluhluwe, 30.xi.1973, in British Museum (Natural History), London.

Paratypes. SOUTH AFRICA: 1 ♂, locality as holotype, 29.xi.1973 (*Zumpt*) (BMNH). MOZAMBIQUE: 1 ♀, Lourenço Marques, Raikatla, ix–xii.1913 (*H. A. Junod*) (BMNH).

AFFINITIES. This is the only Afrotropical species of *Rhinomorinia* having posterodorsal setae on the fore tibia, and the name *setitibia* alludes to this character. Nevertheless, the affinities of *setitibia* lie certainly with *R. atra*, the two species being nearly identical except for the characters mentioned in the foregoing key to males, the absence of pollinosity on the fifth abdominal tergite in the female of *setitibia*, and the chaetotactic difference in the fore tibiae already mentioned.

Rhinomorinia verticalis sp. n.

DESCRIPTION. ♂. Head ground colour black, except for subparafacials and subocular strips dark reddish brown; upper occiput and upper parts of parafrontals rather shining, lower parts of parafrontals and parafacials silvery white pollinose; antennae dark brown, partially suffused with paler reddish colouring on second segment and base of third; palpi tawny yellow. Head higher than long, eye profile broadly suboval and slightly oblique, vibrissal angles only weakly prominent, upper occiput very slightly swollen. Eyes very widely separated, frons at narrowest about 0·33 of head-width. One pair of very strong proclinate orbital setae (with or without one or two supernumerary proclinate setulae in addition). Prevertical seta present, very strong and directed conspicuously outwards; outer vertical setae present, strong. Parafacials moderately broad, at mid point slightly over half as wide as third antennal segment, sparsely stiff haired on upper halves. Upper occiput with irregular stiff black setulae behind the postocular row. Antennae small, not reaching epistome, third segment about 1·6 times as long as second segment; arista pubescent. Proboscis short. Thorax black, humeral calli and notopleura thinly grey pollinose and prescutum with a pair of short faintly marked submedian greyish vittae (these somewhat evanescent and not evident from all angles); pleural regions only noticeably grey pollinose on the propleura. Three humeral setae (a small but distinct inner seta present in addition to main two). *Acr* setae well differentiated, 1(+) + 1(2). 2–3 *stpl* setae. Pteropleural seta weak. Infrasquamal hairs present or absent. Scutellum with extremely strong apical setae subequal in size to lateral setae, latter about equidistantly inserted between scutellar base and apical setae, basal setae undifferentiated. Legs black; claws medium-sized (slightly shorter than last tarsal segments). Fore tibia without submedian *pd* seta, with a small setula in the preapical *pd* position. Mid femur with two or three differentiated setae on the *a* surface. Mid tibia with one *ad* seta. Hind tibia with two *ad* and two *av* setae. Wings very faintly tinged yellowish brown; basicosta pale yellow; halteres orange-yellow. Cell R_5 closed and with a *very* short rudimentary petiole that is about half as long as *r–m* or slightly less; *m–cu* at right-angles to *M*, meeting *M* about mid-way between *r–m* and the bend; costal spine not very strong, shorter than second costal sector and not more than one-and-a-half times as long as *r–m*; costa without unusually strong spinules; basal node of R_{4+5} with one or two setulae, main one long but not unusually strong. Calyptrae translucent yellowish white. Abdomen black and partially shining, with grey or brownish grey pollinosity, the pollinosity mainly confined to the anterolateral parts of T3 and T4 but more diffuse and less obvious on T5. Abdominal T3 medially with long recumbent marginal hairs but without erect median marginal setae; intermediate tergites without discal setae and with recumbent hairing. T7 + 8 and epandrium without strong setae, latter not very large. Measurements: body length 3·3–3·4 mm, wing length 3·2–3·3 mm [2 specimens].

♀. Extremely like the ♂, with almost identical head.

MATERIAL EXAMINED. Holotype ♂, SOUTH AFRICA: Cape Province, George District, Outeniqua Pass, 24.x.1964 (*B. & P. Stuckenberg*), in Natal Museum, Pietermaritzburg.

Paratype. SOUTH AFRICA: 1 ♀, Cape Province, nr Oudtshoorn, x.1931 (*Miss A. Mackie*) (BMNH).

In addition to the two specimens cited above I have seen two specimens (one of each sex) from Natal that are probably this species, but which differ slightly from the Cape Province type-material and that I think it preferable to omit from the type-series. These specimens have the antennae more uniformly blackish brown than in the holotype and paratype, and the abdominal pollinosity is paler and formed into more distinct broad bands on the basal halves of the intermediate tergites. Their data are: 1 ♂, Natal, Drakensberg Mts, 1800 m [5800 ft], Giants' Castle Reserve, 1.xi.1972 (*M. E. Irwin*) (NMP); 1 ♀, Natal, Pietermaritzburg, 23.xi.1973 (*F. Zumpt*) (BMNH).

AFFINITIES. Rather uncertain, but perhaps closest to *R. scutellata* with which it runs out in the foregoing key to females.

Rhinomorinia scutellata sp. n.

DESCRIPTION. ♀. Head ground colour blackish on occipital regions, parafrontals, parafacials and genal dilations, occiput and upper third of parafrontals rather shining (latter with brassy reflections), the parafacials and lower parts of parafrontals with silvery white pollinosity which changes in appearance with direction of the light (at certain angles an abrupt change in apparent colour at junction of parafacial and parafrontal); interfrontal area reddish brown; subparafacial areas and subocular strips reddish orange; face tawny yellowish; antennae brownish black; palpi yellow. Head higher than long, eye profile broadly suboval and oblique, epistome well warped forwards from face but a little less prominent than profrons, upper occiput flat. Eyes widely separated, frons about 0·35 of head-width. One pair of proclinate orbital setae. Prevertical setae present, outer vertical setae absent. Parafacials rather wide, at mid point almost as wide as third antennal segment, with some short stiff hairing on uppermost three-fifths. Upper occiput with black setulae behind the postocular row. Antennae medium-sized, third segment 1·9 times as long as second segment; arista micropubescent. Proboscis short. Thorax shining black with a pair of submedian white-pollinose vittae on the prescutum that do not quite reach the transverse suture but otherwise almost devoid of pollinosity (only thin traces of whitish pollinosity on pleural regions, especially propleura, and in some lights traces of dark greenish brown pollinosity in two pairs of incomplete lines on the scutum). Two humeral setae. *Acr* setae very weakly differentiated. Two *stpl* setae (third weakly differentiated on one side in specimen seen). Pteropleural seta strongly differentiated (about as long as or slightly longer than notopleural setae). Infrasquamal hairs absent. Scutellum with small apical setae that are slightly less than half as long as the lateral setae, the latter inserted equidistantly between the scutellar base and the apical setae, basal setae absent [apical setae directed upwards instead of horizontally in the one specimen (holotype) seen, the feature apparently natural but possibly due to derangement]. Legs black. Fore tibia without *pd* setae. Mid femur with a row of about seven well-differentiated setae along the *a* surface. Mid tibia with two *ad* setae. Hind tibia with two *ad* setae and two *av* setae. Wings very faintly smoky brownish; basicosta reddish yellow; halteres yellow. Cell R_5 closed at the wing margin; *m–cu* at right-angles to *M* and mid way between *r–m* and the bend; costal spine very strong, about as long as second costal sector and twice as long as *r–m*; first costal sector with unusually sparse enlarged spinules standing out erectly (third sector with smaller but also distinctly enlarged spinules); basal node of R_{4+5} with a small setula accompanied by one or two hairs. Calyptrae yellow. Abdomen shining black with slight brassy reflections in some lights, T3 and T4 with very thin and inconspicuous pale greyish or greenish grey pollinosity best seen as the fly is turned. Abdominal T3 without median marginal setae, intermediate tergites without discal setae and with short moderately dense recumbent hairing. Measurements: body length 4·3 mm, wing length 3·8 mm [1 specimen].

♂. Unknown.

MATERIAL EXAMINED. Holotype ♀, SOUTH AFRICA: Cape Province, Stellenbosch, 4.ix.1926 (*R. I. Nel*), in British Museum (Natural History), London. (Holotype lacking mid and hind legs of the left side from the trochanters.)

AFFINITIES. Probably closely allied to *R. bisetosa* but differing by having one pair of proclinate orbital setae (♀), narrower interfrontal area, non-pollinose humeral calli and notopleura, and by lacking grey-pollinose vittae on the scutum. It is similar to *bisetosa* in lacking outer vertical

setae (♀) and in having rather small apical scutellar setae. The holotype (only known specimen) is specially interesting because the apical scutellar setae, though crossed, are directed almost straight upwards in what appears to be a natural posture; the orientation of these setae on the holotype might, however, be due to accidental displacement, and only further material can show if the upward orientation is a natural feature of the species. If it is, then *R. scutellata* is the only Afrotropical species of rhinophorid with upright apical scutellars.

Rhinomorinia bisetosa sp. n.

DESCRIPTION. ♂. Head ground colour blackish on parafrontals, parafacials, genal dilations and posterior surface but obscured by rather thick greyish white or ashy pollinosity; interfrontal area reddish orange on anterior third and dark reddish brown on the posterior two-thirds (colour transition usually rather gradual), subparafacial areas and facial ridges yellowish orange (especially when seen from below); antennae blackish brown except bases of third segments narrowly yellow-orange; palpi yellow. Head higher than long, eyes rather broadly subovate in profile, facial profile long and vibrissal angles moderately strongly prominent. Eyes not approximated, frons very wide and about 0·375 of head-width. Two pairs of proclinate orbital setae present. Prevertical setae present, outer vertical setae absent. Parafacial at mid point about half as wide as third antennal segment, with a few stiff hairs on uppermost quarter or two-fifths. Upper occiput with long fine sparse setulae behind the postocular row. Antennae long and heavy, third segment about 2·4 times as long as second segment and almost reaching the epistome; arista micropubescent. Proboscis short. Thorax black with pale grey pollinosity on pleural regions, thick greyish white pollinosity on humeral calli and notopleura, and with a pair of complete silvery or greyish pollinose vittae on prescutum and scutum (the vittae more or less reaching the scutellum); scutellum all black. Two humeral setae (weak innermost third sometimes differentiated). *Acr* setae undifferentiated or represented by weak setulae. Two or three *stpl* setae. Pteropleural seta well differentiated (almost as large as notopleural setae). Infrasquamal hairs absent or very few and minute. Scutellum with weak apical setae that are slightly less than half as long as the lateral setae, basal setae absent. Legs black; claws of medium length. Fore tibia without *pd* setae. Mid tibia with one or two *ad* setae. Hind tibia with two *ad* setae and two *av* setae. Wings very faintly brownish to naked eye, the veins yellowish basally; basicosta pale yellow; halteres orange-yellow. Cell R_5 varying from narrowly open to closed at wing edge to very short-petiolate (if trace of petiole present, as in holotype, then not longer than half of *r–m*); *m–cu* at right-angles to *M* and about mid way between *r–m* and the bend; costal spine not very strong, shorter than second costal sector and less than twice as long as *r–m*; spinules of first costal sector numerous and not noticeably enlarged or erect; basal node of R_{4+5} with inconspicuous hairs or setulae. Calyptrae yellowish white. Abdomen black with conspicuous greyish white pollinosity on anterior halves of T3, T4 and T5, pollinosity absent medially on the tergites and the pale-pollinose bands interrupted on the mid-part of the abdomen. T3 without median marginal setae, both T3 and T4 without discal setae, hairing recumbent. Measurements: body length 3·0–3·3 mm, wing length 2·7–2·9 mm [4 specimens].

♀. Extremely like the ♂ but with much narrower white-pollinose banding on intermediate tergites and with T5 entirely shining black (lacking a pale pollinose band).

MATERIAL EXAMINED. Holotype ♂, SOUTH AFRICA: Cape Province, Bredasdorp District, Arniston coastal dunes, 22–23.x.1964 (*B. & P. Stuckenberg*), in Natal Museum, Pietermaritzburg.

Paratypes. 3 ♂, 7 ♀, same data as holotype (♂ & 2 ♀ in BMNH, remainder in NMP, Pietermaritzburg).

AFFINITIES. A distinctive species easily recognized by the colour of the interfrontal area in conjunction with the presence of two pairs of proclinate orbital setae (to which character the specific name alludes), and perhaps most closely allied to *R. xanthocephala* (with which it agrees, for example, in having unusually small apical scutellar setae, outer vertical setae and broad male frons with both prevertical and proclinate orbital setae).

Rhinomorinia xanthocephala (Bezzi) comb. n.

Hoplisa xanthocephala Bezzi, 1908 : 187; Villeneuve, 1916 : 511. LECTOTYPE ♂, by present designation, SOUTH WEST AFRICA (MNHU, Berlin) [examined].

Hoplisa novicia Villeneuve, 1916 : 511; Zumpt, 1959 : 432. LECTOTYPE ♂, by present designation, SOUTH AFRICA (SAM, Cape Town) [examined]. **Syn. n.**

LECTOTYPE DESIGNATIONS. (1) *xanthocephala*. This species was described from four ♂ and two ♀ syntypes in alcohol, all with the same data and collected at Rooibank, South West Africa. Two ♂ syntypes have been located, both in Museum für Naturkunde der Humboldt-Universität, Berlin, both in alcohol and both in damaged and faded condition after long preservation in spirit. The two syntypes are conspecific. They have been placed in separate tubes, one labelled (and here designated) as lectotype and the other labelled as paralectotype; a slide preparation has been made of the genitalia from the paralectotype.

(2) *novicia*. This nominal species was described from two 'examples' from Barberton in the Transvaal and stated to be in the South African Museum, and from one 'example' in the 'Hofmuseums' (i.e. Naturhistorisches Museum), Vienna. Three specimens have been located that are believed to be the whole type-series, although none of them is clearly and unequivocally labelled as being a 'type' (however, this is not unusual with Villeneuve's earlier work); all are males. One specimen exists in the SAM, Cape Town, collection and is here designated as lectotype: it bears a white label with the words 'Barberton Transv.' in black ink and a faded blue label with the words 'Hoplisa novicia Villen.' in black ink in Villeneuve's writing. The second specimen is from the NM, Vienna, collection and is labelled 'Cap b. sp. Coll. Winthem', 'capensis i. litt. det. B.B.' (both labels partly handwritten, partly printed), and 'Hoplisa capensis n. sp. (det. Villeneuve)', the last being one of Villeneuve's usual blue labels with his black ink handwriting. Villeneuve never published the name 'Hoplisa capensis' but the specimen bearing this label is believed to be the '1 example, Hofmuseums, Vienna' mentioned in Villeneuve's description of *novicia* (it is inferred that Villeneuve originally intended to call his species 'capensis' but changed his mind and published it as *novicia*, without remembering or having an opportunity to re-label the specimen). The third specimen is in the BMNH collection, has a black ink label reading 'Barberton Transvaal' and another label with the words 'Hoplisa novicia Villen. Villeneuve det.' in what appears to be van Emden's handwriting; there is no evidence as to how the BMNH acquired this specimen, and its type-status is not completely certain, but it is accepted as an original syntype in the absence of contrary evidence. The NM, Vienna and BMNH specimens have been labelled as paralectotypes and a slide preparation has been made of the genitalia of the BMNH specimen. Zumpt (1959) erroneously stated that there was no type-material of *novicia* in the South African Museum.

DESCRIPTION. ♂. Head ground colour blackish or dark greyish on occipital region, parafrontals, ocular margins of the parafacials, postbuccae and posterior parts of genal dilations, and yellow or reddish yellow on face, facial margins of parafacials, subparafacial areas, epistome and anterior parts of genal dilations; interfrontal area orange-yellow, rarely dark brown on upper parts against the parafrontals; most of head with thin whitish pollinosity, the pale pollinosity overlying the dark parafrontals giving the parafrontals a dark slaty grey or even slightly bluish grey appearance in strong contrast to the orange-yellow interfrontal area; antennae dark brown with apices of second segments and bases of third segments yellowish brown or orange; palpi yellowish. Head almost as long as its height (shape as Fig. 8), eye profile almost subcircular, epistome extremely strongly warped forwards from the face and very sharp, upper occiput distinctly swollen. Eyes very widely separated, frons about 0·43 of head-width. One pair of very strong proclinate orbital setae. Prevertical setae present, strong and directed conspicuously outwards; outer vertical setae present, strong. Parafacials slightly narrower than third antennal segment, with sparse stiff hairs on most of their height. Upper occiput with sparse setulae behind the postocular row. Genal dilation with a very strong seta on the anteroventral corner. Antennae rather heavy, reaching nearly to the epistome, third segment about twice as long as second; arista pubescent. Proboscis slightly elongate. Thorax black with a pair of large continuous pale ashy grey pollinose vittae on the dorsum, similar thick pale grey pollinosity on humeral calli and notopleura, and thin greyish white pollinosity on pleural regions; dark areas of thoracic dorsum appearing brassy-brownish pollinose in certain lights. Two humeral setae. *Acr* setae variable, usually 1+1 pairs differentiated, sometimes undeveloped or developed haphazardly on the prescutum. Two *stpl* setae, occasionally the lowermost (third) seta weakly differentiated. Pteropleural seta weak, smaller than notopleural setae. Infrasquamal hairs usually absent. Apical scutellar setae extremely weak or even hair-like, much less than half as long as lateral setae, the lateral setae inserted higher than usual on sides of the scutellum and closer to the apical setae than to scutellar base; basal setae absent. Legs black; claws medium-sized (slightly shorter than last tarsal segment). Fore tibia without *pd* setae. Mid femur with a row of four or more strong setae on the *a* surface. Mid tibia with two *ad* setae. Hind tibia with two *ad* setae and two *av* setae (proximal *av* seta sometimes

minute). Wings hyaline or at most with a faint trace of yellowish brown colour; basicosta pale yellow; halteres yellow. Wing venation as Fig. 22: cell R_5 usually narrowly open but sometimes just closed at wing margin (no trace of petiole); *m–cu* at right-angles to *M* but sometimes slightly oblique in relation to Cu_1 so that the inner angle with Cu_1 is acute; *m–cu* meeting *M* mid way between *r–m* and bend or slightly nearer to *r–m*; costal spine extremely strong, much longer than second costal sector and usually about three times as long as *r–m*; costa with unusually sparse strong and outstanding spinules, especially on first sector; basal node of R_{4+5} with a very strong setula, usually accompanied by smaller setulae. Calyptrae creamy white or creamy yellowish. Abdomen black with conspicuous bands of silvery grey pollinosity on basal halves of T3–T5, the pale bands on T3 and T4 narrowly interrupted medially and sometimes indefinite on T5. Abdominal T3 with a pair of extremely long strong erect median marginal setae; intermediate tergites with long recumbent hairing, T4 with a pair of short fine erect median discal setae (occasional specimen with the discals of T4 moderately strong and then a pair of discals also on T3). T7+8 and epandrium with strong setae, latter not very large; cerci and surstyli long and narrow, subequal in length; ejaculatory sclerite moderately large and fan-shaped. Measurements: body length 2·9–3·8 mm (mean 3·2), wing length 2·4–3·3 mm (mean 2·8) [10 specimens].

♀. Extremely similar to ♂, but last visible abdominal tergite (T5) appearing entirely shining black from above (pale pollinosity present only on the anteroventral parts of the tergite). Discal setae of T4 sometimes extremely small. Measurements similar to ♂.

MATERIAL EXAMINED. Lectotype ♂ of *xanthocephala*, SOUTH WEST AFRICA: Rooibank, nr Walvis Bay, v.1905 (*L. Schultze*), in Museum für Naturkunde der Humboldt-Universität, Berlin. Lectotype ♂ of *novicia*, SOUTH AFRICA: Transvaal, Barberton (no other data), in South African Museum, Cape Town.

SOUTH AFRICA: 1 ♂, Transvaal, Barberton (paralectotype of *novicia*) (BMNH); 1 ♀, Orange Free State, North Banks Halt, Norvals Point, 14.iv.1934 (*J. Ogilvie*) (BMNH); 1 ♀, Natal, Durban, 14–18.x.1931 (*J. Ogilvie*) (BMNH); 3 ♂, 4 ♀, Natal, Zululand, St Lucia, coastal dunes, 8 m, 2832 Ad, 24.xi.1971 (*M. E. & B. J. Irwin*) (2 ♂, 3 ♀ NMP, 1 ♂, 1 ♀ BMNH); 1 ♂, Cape Province, Oudtshoorn, x.1931 (*Miss A. Mackie*) (BMNH); 1 ♂, Cape Province, Mossel Bay, xii.1934 (*R. E. Turner*) (BMNH); 1 ♀, Cape Province, Cape Town, Kloof Nek, 1–2.i.1972 (*B. H. Cogan*) (BMNH); 1 ♀, Cape Province, Port Elizabeth, x.1931 (*Miss A. Mackie*) (BMNH); 1 ♀, Cape Province, Clanwilliam District, Pakhuis Pass, 950 m, 17–19.x.1964 (*B. & P. Stuckenberg*) (NMP); 4 ♂, Cape Province, East London, coastal dunes, 5 m, 3237 Dd, 16.iii.1972 (*M. E. & B. J. Irwin*) (3 ♂ NMP, 1 ♂ BMNH); 1 ♀, Cape Province, Calvinia District, Brandkop, 14.x.1964 (*B. & P. Stuckenberg*) (NMP); 3 ♂, 1 ♀, Cape Province, South-West Cape, Atlantic coast, 20.x.1964 (*B. & P. Stuckenberg*) (2 ♂, 1 ♀ NMP, 1 ♂ BMNH); 1 ♂, 2 ♀, Cape Province, Cape of Good Hope nature reserve, 7–10.iii.1968 (*P. Spangler*) (USNM); 3 ♂, 1 ♀, Cape Province, Bradesdorp District, Arniston coastal dunes, 22–23.x.1964 (*B. & P. Stuckenberg*) (2 ♂, 1 ♀, NMP, 1 ♂ BMNH); 11 ♂, 5 ♀, Cape Province, South-West Cape, Strandfontein, coast west of Van Rhynsdorp, 15–17.x.1964 (*B. & P. Stuckenberg*) (8 ♂, 4 ♀, NMP, 3 ♂, 1 ♀, BMNH); 1 ♂, Cape Province, 'Cap b. sp.' (NM, Vienna). SOUTH WEST AFRICA: 1 ♂, Rooibank, nr Walvis Bay, v.1905 (*L. Schultze*) (paralectotype of *xanthocephala*) (MNHN).

VARIATION AND SYNONYMY. *Rhinomorinia xanthocephala* as here accepted is slightly variable, and it is possible that it is not one species but a complex of two or more semi-sibling species. The interfrontal area is wider in some specimens of the same sex than others, and occasionally the upper part of the interfrontal area against the parafacials is dark brown instead of uniformly orange-yellow. The parafacials vary somewhat in width, and are sometimes almost entirely yellow instead of dark greyish against the eyes and yellow against the facial ridges; the extent of hairing on the parafacials is also variable. Variation in antennal size occurs, some specimens having much heavier antennae than others but not being noticeably different in the proportions of the third and second segments. The thorax, legs and wings are fairly constant, though slight differences occur in the wing venation between different specimens (especially regarding the point at which *m–cu* joins *M* in relation to *r–m* and the bend and its degree of obliqueness in relation to Cu_1). The extent of pale pollinosity on the abdomen, especially in the male, varies, some specimens having the silvery or grey pollinosity confined to about the basal third of each intermediate tergite and others having it much more extensive. The male genitalia are confusing, and the exact shape of the surstyli and cerci is rather variable. In most specimens examined the cerci

taper rather regularly towards their apices and are generally very narrow seen from behind, but in some specimens the cerci in posterior view are broader and rather suddenly contract at the apices (suggesting that two species might be involved); the surstyli in profile are usually rather parallel-sided, but in occasional specimens are clearly wider at the base than towards the apex.

No obvious correlation has been found in the variables just mentioned, and I am unable on present evidence to decide whether more than one species is involved. More critical study of longer series (when these are available), perhaps with host data, will be needed to decide this, but I consider it justified at this stage to synonymize *novicia* with *xanthocephala*. The primary types of these names agree closely with each other, and the cerci in both are of the rather evenly tapering kind, so that even if *xanthocephala* is found to be a mixture of species it appears that *novicia* will remain a synonym of *xanthocephala*. Villeneuve (1916) distinguished his *novicia* from *xanthocephala* on head shape and colour but I am not able to substantiate these differences from direct comparison of types (though admittedly the type-material of *xanthocephala*, after long preservation in alcohol, is badly decolorized). As far as shape is concerned, I find this to vary more than usual with condition of the material (whether teneral or not), and attach no significance to the apparent difference between *novicia* and *xanthocephala* that Villeneuve mentioned. The chaetotaxy of the two is identical, including the presence in both types of the unusually strong peristomal seta inserted on the anteroventral corner of the genal dilation that is such a conspicuous feature of this species.

AFFINITIES. A distinctive species easily recognized by the orange-yellow interfrontal area and largely yellow head, continuous pale vittae on thoracic dorsum, and the enormous costal spine and sparse enlarged costal spinules (especially on the first costal sector). Perhaps fairly closely allied to *R. bisetosa*.

Rhinomorinia vittata (Brauer & Bergenstamm) **comb. n.**

Oxytachina vittata Brauer & Bergenstamm, 1891 : 369 (65) (attrib. Wiedemann); Townsend, 1935 : 252; Townsend, 1938 : 196. Holotype ♀, SOUTH AFRICA (NM, Vienna) [examined].

DESCRIPTION. ♀. Head ground colour blackish on posterior surface, frons, parafacials and genal dilations, reddish orange on subparafacials, subocular strips and the face, tawny yellowish at the epistome; head rather thickly yellowish white pollinose, especially on parafrontals and parafacials; antennae with second segments reddish brown, third segments dark brown with extensive bright orange colouring basally on the inner surface; palpi yellow. Head shape as Fig. 9, eye profile broadly suboval, epistome prominent but rather blunt, upper occiput conspicuously swollen. Eyes very widely separated, frons 0·41 of head-width. Two pairs of proclinate orbital setae. Prevertical and outer vertical setae present (latter rather weak). Parafacials very broad, at mid point appreciably wider than third antennal segment, with some stiff hairs on about upper third. Upper occiput with large black setulae behind the postocular row. Antennae medium-sized, third segment about 1·6 times as long as second segment; arista micropubescent. Proboscis slender, conspicuously elongated and tapering, a little longer than height of the head (Fig. 9), palpi also longer than usual. Thorax brownish black with the ground colour largely obscured by thick pale greyish yellow pollinosity, the pollinosity covering the pleural regions, humeral calli and notopleura, median two-thirds of the scutellum, and forming a pair of very broad continuous vittae on prescutum and scutum which join each other posteriorly just before the scutellum (distribution of pale pollinosity giving thorax the appearance of having a median and paired sublateral brownish black broad vittae and a black-margined scutellum). Three humeral setae. 1+1 *acr* setae. Three *stpl* setae (lowermost one just differentiated). Pteropleural seta weak and smaller than notopleural setae. Infrasquamal hairs present but very minute and inconspicuous. Scutellum with strong apical setae [missing on holotype but large pores evident], lateral setae inserted equidistantly between scutellar base and apical setae, basal setae absent. Legs blackish brown. Fore tibia without *pd* setae. Mid femur with an interrupted row of about four or five setae well differentiated on the *a* surface. Mid tibia with two *ad* setae. Hind tibia with two *ad* and two or three *av* setae. Wings almost hyaline, veins reddish yellow; basicosta pale yellow; halteres yellow. Cell R_5 just closed at wing margin; *m–cu* conspicuously oblique in relation to *M*, joining *M* nearer to the bend than to *r–m*; costal spine very strong, as long as second costal sector and nearly three times as long as *r–m*; spinules of first costal sector distinctly enlarged; basal node of R_{4+5} with a very strong setula accompanied by one or two hairs. Calyptrae creamy white. Abdomen brownish black extensively covered with pale yellowish to greyish yellow pollinosity, pollinosity only missing from apical

half of T5, and the posterior parts and mid-line of T3 and T4 (but boundary between pale pollinose basal parts and shining brownish black apical parts of T3 and T4 dorsum not very sharply defined). Measurements: body length 7·2 mm, wing length 5·6 mm [1 specimen].

♂. Unknown.

MATERIAL EXAMINED. Holotype ♀, SOUTH AFRICA: Cape Province, Cape of Good Hope, in Naturhistorisches Museum, Vienna.

The holotype is the only known specimen. It was part of von Winthem's collection and bears a label reading 'vittata 126. Cap b. sp. Coll. Winthem' (the words coll. Winthem printed, remainder in black ink script). Villeneuve evidently saw the specimen, though he apparently did not publish on it, for it also has a blue rectangular Villeneuve label reading 'Oxytachina Dr Villeneuve det. ead. nom.' (the words Dr Villeneuve det. printed, remainder in black ink in Villeneuve's hand). The condition is good except for a tear near the base of the right wing and loss of a few head bristles and the apical scutellar bristles.

AFFINITIES. Not certain and it is difficult to suggest which species are the nearest relatives of *vittata*. Brauer & Bergenstamm's name is specially apt, as the extent of the pale pollinosity on the thoracic dorsum gives the fly the impression of being trivittate (with three broad black lines separated by pale areas). This patterning is unique in the genus, as also are the unusually attenuate proboscis, and the pale-vittate scutellum. The lower anterior corner of the genal dilation bears a very strong seta similar to that occurring in this position in *R. xanthocephala*, and the first costal sector has obviously enlarged spinules approaching the kind found in *xanthocephala*, and *vittata* might be closer phyletically to *xanthocephala* than the obviously very different general facies would suggest.

Genus *PHYTO* Robineau-Desvoidy

Phyto Robineau-Desvoidy, 1830 : 218. Type-species: *Phyto nigra* Robineau-Desvoidy, 1830 [= *Tachina melanocephala* Meigen, 1824], by designation of Robineau-Desvoidy (1863 (2) : 48).

Styloneuria Brauer & Bergenstamm, 1891 : 365 (61). Type-species: *Styloneuria manni* Brauer & Bergenstamm, 1891 [= *Phyto adolescens* Rondani, 1861], by original designation and monotypy ('gen. n., sp. n.' situation).

Britea Curran, 1927 : 127. Type-species: *Britea tachinoides* Curran, 1927, by original designation. **Syn. n.**

Other synonyms: several other generic synonyms (see Herting, 1961).

DIAGNOSIS. Head shape slightly varied, Afrotropical forms as Figs 11 & 16. Eyes narrowly suboval to subcircular in outline, usually oblique; gena large, its depth much greater than antennal width. Epistome very weakly to strongly warped forwards from the face, facial profile nearly straight to conspicuously concave. Vibrissal angles usually weak, occasionally prominent, usually slightly less prominent than the profrons; vibrissae inserted below lowermost point of the eye, but well above lowermost point of the head. Eyes of ♂ either widely separated as in ♀ or approximated, often so strongly approximated that frons at narrowest point not as wide as the antenna. ♂ with or without proclinate orbital setae, with or without prevertical setae, and with or without outer vertical setae. Parafacials of varied width but well visible in profile, wholly or partially haired (hairing very sparse or virtually absent in occasional specimen). Antennae small or medium-sized, usually falling far short of epistome; arista bare to plumose. Proboscis of varied length, usually short but as long as or longer than head height in some Afrotropical forms. Pre-alar seta strong, about as large as or larger than notopleural setae (except in *P. pauciseta* Herting). Presutural *acr* setae present. Lower prostigmatic seta hair-like or virtually absent. Pteropleural seta small or completely undifferentiated. Barette usually haired, especially anteriorly, sometimes bare. Apical scutellar setae strong, slightly smaller than to stronger than lateral setae, scutellum often with a pair of basal setae in addition (laterals themselves sometimes inserted close to scutellar base). Mid tibia with one or more *ad* setae. Hind tibia with two or more *ad* setae, one or two *av* setae and a *pv* apical seta. Wing venation as or usually similar to Fig. 23: cell R_5 narrowly open or closed in wing margin or short-petiolate (if petiole present then at most about half as long as *m–cu*); bend of vein *M* usually rather abrupt but sometimes gently and evenly curved, the change of direction always widely obtuse (as Fig. 23); *m–cu* straight to moderately strongly sinuous, usually distinctly oblique in relation to *M* but sometimes at right-angles; basal node of R_{4+5} setulose or bare; costal spine absent to strong. Abdomen with or without discal setae; abdominal T1+2 with or without median marginal setae. ♂ genitalia with long narrow cerci and surstyli (subequal in length in species examined).

Distribution. Palaearctic Region, eastern and southern Africa. Known distribution mainly southern European, but genus occurs northwards to England and eastwards to the Middle East, and occurs in North Africa and Canary Islands.

Hosts and early stages. Species of *Phyto* attack woodlice of the genera *Oniscus* Linnaeus, *Porcellio* Linnaeus and *Armadillidium* Brandt & Ratzeburg. Thompson (1934) records *P. melanocephala* as attacking *Porcellio scaber* L., and *P. discrepans* Pandellé as attacking *P. scaber* L. and *Oniscus asellus* L., and cites Donisthorpe as having reared *P. melanocephala* from *Armadillidium vulgare* Latreille [Thompson's reference to Donisthorpe is incomplete and I have been unable to trace the original]. Early stages of *P. melanocephala* and *P. discrepans* are described by Thompson (1934) and Bedding (1973).

Discussion. This genus, along with *Stevenia* Robineau-Desvoidy, is one of the largest genera of Rhinophoridae, and Herting (1961) recognizes 12 species, all confined to the Palaearctic Region. But the genus *Phyto* certainly occurs in the Afrotropical Region also, and in the present work I assign to it one previously described East African species and four new species (two of the latter rather doubtfully, as discussed below).

The previously described Afrotropical species that unquestionably belongs in *Phyto* is *Britea tachinoides* Curran, a valid species that Curran (1927) originally described in the Sarcophagidae and that is type-species of the nominal genus *Britea* Curran described at the same time. However, *Britea tachinoides* is obviously not a sarcophagid, and this was known to Townsend and Villeneuve not long after its description. Townsend (1931 : 384) reported that *Britea* was 'close to *Paramorinia*, BB', and this statement clearly implied its rhinophorid affinities, as *Paramorinia* Brauer & Bergenstamm is synonymous with *Phyto* (see, for example, Herting, 1961): Townsend's (1935: 260; 1938 : 218) later placements of *Britea* as a (valid) genus of Moriniini also imply assignment to the group now termed Rhinophoridae.

Villeneuve (1932 : 272), in an easily overlooked 'tail-piece' comment to a paper on Formosan Tachinidae (!), unambiguously placed *Britea* in rhinophorids and by implication synonymized this generic name with *Styloneuria* Brauer & Bergenstamm, also by implication establishing a combination *Styloneuria tachinoides* (Curran). Villeneuve's remark is worth full quotation, as follows: 'En effet, cette espèce [*Britea tachinoides*] est identique à *Styloneuria maculosa* Villen. in litt., elle appartient donc aux Rhinophorinae de la tribu *Phyto*. Le genre *Styloneuria* B. B. est demeuré méconnu des auteurs américains. La première cellule postérieure de l'aile peut être ouverte, fermée ou pétiolée dans ce genre.' (Villeneuve's specific name *maculosa* was never, in fact, separately published and this name remains an unavailable name first published as a synonym with *tachinoides*.)

Herting (1961) treats both *Paramorinia* and *Styloneuria* as synonyms of *Phyto*, and I completely agree with this treatment. Villeneuve was correct to place *Britea tachinoides*, type-species of *Britea*, in *Styloneuria*, and the species now assigns to *Phyto* in view of the synonymy of *Styloneuria* with *Phyto*. Hence *Britea* is here treated as a new synonym of *Phyto*, and the new combination of *Phyto tachinoides* is formally established. (Herting did not deal with *Britea*.)

P. tachinoides is a species of *Phyto* with extremely strongly approximated eyes in the male and exceptionally long fine bristling and hairing. Other similar previously undescribed species occur in tropical and southern Africa; two are newly described here on the basis of specimens in the BMNH collection, and both of them are undoubtedly assignable to *Phyto*.

In addition I have seen three female specimens from the Natal Museum belonging to two distinct but closely allied species that are more doubtfully assignable to *Phyto*. Both species are new and justify description, but I am not fully certain that they ought to be placed in *Phyto*. However, there is no other suitable existing genus and I prefer to describe them in *Phyto* rather than erect a new genus for them, for they certainly possess many of the principal characteristics of *Phyto*. The head is rather longer and more strongly swollen occipitally, the eyes more subcircular and the proboscis more elongate (Fig. 11) than is typical of *Phyto*, but most other features (including the large pre-alar seta) are those of *Phyto*. It appears best to place these two new species in *Phyto* as an interim measure, until they can be better assessed in the light of more material and of males (male sex unknown at present).

Finally here it may be of interest to note that to confirm the generic placement of *tachinoides* Curran in *Phyto* I have examined the male hypopygium; it is extremely similar to that of *Phyto melanocephala*, type-species of *Phyto*, and confirms beyond doubt the congenericity of the two species, and therefore the synonymy of *Britea* with *Phyto*.

Key to Afrotropical species of *Phyto* Robineau-Desvoidy

[*Note*. The key cannot be complete as three of the species are known only from males and two only from females.]

1 Males 2

– Females 4

2 Prescutum and scutum with conspicuous pattern, median third of prescutum and its hind margin and posterior third or two-fifths of scutum thickly pale yellowish pollinose (pale pollinose areas strongly contrasting with black sublateral areas of prescutum and anterior part of scutum). Three *stpl* setae. Three humeral setae (in triangle). Interfrontal area obliterated at narrowest point of frons by contiguous parafrontals, frons at narrowest point not more than 0·065 of head-width. Arista distinctly plumose. Parafacial well visible in profile. Usually three *post ia* setae, median one (or anterior one if only two present) as close to or closer to hindmost one than to transverse suture. [East Africa] 3

– Prescutum and scutum without such pattern, brownish black except for a pair of narrow silvery greyish pollinose vittae on the prescutum (the vittae lying between the *dc* and *acr* setae and separated by a black median vitta). Two *stpl* setae. Two humeral setae. Interfrontal area distinct on whole height of the frons, parafrontals not juxtaposed, frons at narrowest point about 0·08 of head-width. Arista long-pubescent. Parafacial narrow and only just visible on lower part in profile. Two strong *post ia* setae, anterior one closer to transverse suture than to hindmost one. [South Africa]. . . . . . . ***P. parafacialis*** sp. n. (p. 43)

3 Arista long-plumose, hairing equally long on upper and lower surfaces and the longest hairs longer than the width of the frons at its narrowest point. Head ground colour entirely blackish, the subparafacial areas and interfrontal area velvety black (not paler than rest of the head). Abdominal T3 and T4 with the dark colour extending forwards as an elongate blackish brown triangle on each tergite that has its apex at the anterior margin (separating the pale pollinose basal parts of the tergites into two). Dorsal hairing of abdominal T3 and T4 very long, fine and erect; T3 without discal setae [? constant]. Frons at narrowest point much narrower than third antennal segment, not more than twice as wide as anterior ocellus (0·055 of head-width). . . . . ***P. paratachinoides*** sp. n. (p. 43)

– Arista short-plumose, hairing not as long on lower surface as upper surface and the longest hairs obviously shorter than the width of the frons at its narrowest point. Head not entirely black, the subparafacial areas and the interfrontal area orange-red, brick-red or reddish brown (paler than rest of the head). Abdominal T3 and T4 with the dark areas slightly triangular but not extending forwards in the mid line to the anterior margins of the tergites (bases of the tergites therefore with uninterrupted broad pale pollinose fasciae). Dorsal hairing of abdominal T3 and T4 short and recumbent or virtually so; T3 with one pair of long erect discal setae. Frons at narrowest point only slightly narrower than third antennal segment, conspicuously more than twice as wide as anterior ocellus (0·065 of head-width) ***P. tachinoides*** (Curran) (p. 42)

4 Proboscis very long and slender, much longer than the height of the head (Fig. 11). Interfrontal area exceptionally broad, about 2·6 times as wide as a parafrontal; frons correspondingly broad, its width about 0·43 of head-width. . . . . ***P. longirostris*** sp. n. (p. 44)

– Proboscis slightly elongate but not exceptionally attenuate, subequal in length to the height (and length) of the head. Interfrontal area not exceptionally broad, about 2·0 times as wide as a parafrontal; frons correspondingly narrower, its width about 0·37 of head-width ***P. stuckenbergi*** sp. n. (p. 44)

Certain characters mentioned in the species descriptions that follow are common to all the Afrotropical species. It is nevertheless thought useful to cite them in order to facilitate comparison with European species. For example, some European species possess posterodorsal setae on the fore tibia (other than the preapical one), whereas these are absent in known Afrotropical species, and this fact is therefore stated in the description of each species.

Phyto tachinoides (Curran) **comb. n.**

Britea tachinoides Curran, 1927 : 128; Townsend, 1931 : 384; Villeneuve, 1932 : 272; Townsend, 1935 : 260; Townsend, 1938 : 218; Zumpt, 1956 : 176 (wrongly placed in Tachinidae). Holotype ♂, KENYA (BMNH, London) [examined].
Styloneuria tachinoides (Curran) Villeneuve, 1932 : 272 (implied combination).
Styloneuria maculosa Villeneuve, 1932 : 272. Unavailable name, first published as a synonym.

DESCRIPTION. ♂. Ground colour of head mainly blackish but orange-red, brick red or dark reddish brown on subparafacial areas and interfrontal area; parafrontals and parafacials thickly pale yellowish pollinose, appearance shifting strongly with direction of light, face and genae thinly whitish pollinose; antennae and palpi blackish brown. Head shape as Fig. 16, conspicuously higher than broad, eye suboval and oblique, upper occiput flat. Eyes extremely strongly approximated, frons at narrowest point slightly narrower than third antennal segment (0·065 of head-width) and parafrontals just meeting so as to obliterate interfrontal area for a short distance. Outer vertical setae, prevertical setae and proclinate orbital setae absent. Ocellar setae long and moderately strong. Parafacials moderately broad, at mid point about equal in width to antenna and broadly visible in profile, sparsely haired (position of hairing variable). Antennae short, third segment about 1·75 times as long as second; arista short-plumose, plumosity longest on upper surface but longest hairs no longer than narrowest point of frons. Proboscis very short. Thoracic ground colour entirely brownish black, pleural regions uniformly covered with yellowish white pollinosity, dorsum with boldly marked pattern formed by contrasting dark non-pollinose and pale pollinose areas: prescutum thickly pale yellowish or greyish yellow pollinose on median third and against the hind margin, scutum similarly pale pollinose on about posterior two-fifths, humeral calli and notopleura also thickly pale yellowish pollinose (black and pale yellowish pattern reminiscent of *Trigonospila* in Tachinidae). Three humeral setae (in triangle). Two pairs of presutural *acr* setae. Usually three *post ia* setae with anterior one very fine, first sometimes absent, middle one at least as far from transverse suture as from hindmost one. Three *stpl* setae. Pteropleural seta very long but fine. Barette sparsely fine haired, at least anteriorly. Infrasquamal hairs rather long, abundant and conspicuous. Mesonotal hairing long fine and erect, but not very dense. Scutellum with fine weak basal setae and with lateral setae standing much closer to scutellar base than to apical setae. Legs blackish brown; claws very long. Fore tibia without submedian *pd* setae, with small *pd* preapical seta. Mid tibia with one *ad* seta. Hind tibia with three (+) *ad* setae and with one *av* seta. Wings hyaline or virtually so; basicosta blackish brown; halteres yellow. Wing venation as Fig. 23, cell R_5 narrowly open before the wing tip, bend of M very widely obtuse but slightly abrupt and about as far from wing edge as from *m–cu*, latter strongly oblique in relation to M and rather strongly sinuous; costal spine undifferentiated; basal node of R_{4+5} with long fine hairs (usually from two to four). Calyptrae glassy yellowish white. Abdominal ground colour black, largely obscured on T3–T5 by thick yellowish white or pale greyish yellow pollinosity, T3 and T4 with dark hind margins and extensively dark and non-pollinose in a large median subtriangular area extending forwards from the dark hind margins (pale pollinosity therefore much less extensive medially than laterally), T5 mostly pollinose and only narrowly blackish brown posteriorly. Abdominal T1+2 without median marginal setae, T3 with median marginal setae; T3–T5 each with a pair of strong median discal setae (occasionally duplicated); dorsal hairing of intermediate tergites recumbent or almost so. Postabdomen with T6 well developed, T6 and T7+8 with long fine setae, epandrium without setae among the hairing. ♂ genitalia with long narrow cerci and surstyli, and with large fan-shaped ejaculatory sclerite. Measurements: body length 7·2–8·3 mm, wing length 6·5–7·4 mm [9 specimens].

♀. Unknown.

MATERIAL EXAMINED. Holotype ♂, KENYA: Lumbwa District, Kericho, 2000 m [6500 ft], 21.i.1913 (*C. M. Dobbs*), in British Museum (Natural History), London.

Paratypes. 5 ♂, same data as holotype (4 in BMNH, 1 in AMNH).

5 ♂, same data as type-series (BMNH).

NOTES. Curran described this species from eight males with identical data, six of which have been seen. Other specimens with identical data are in BMNH collection that were seen by Villeneuve, and that he intended to describe, hence Villeneuve's (1932) statement of '*Styloneuria maculosa* Villen. in litt.' One of these is labelled 'Styloneuria maculosa Typ. Villen.', another is labelled 'Styloneuria maculosa n. sp.', and a third is labelled '(Britea Curran) Styloneuria tachinoides Curr.', all three labels in Villeneuve's hand. Every specimen seen has the words 'Caught on wall of house' on its data label in addition to the basic data cited above. Villeneuve's name is nomenclaturally unavailable, since although published it was cited as a synonym of *tachinoides*.

Phyto paratachinoides sp. n.

DESCRIPTION. ♂. Extremely similar to *P. tachinoides* described above but differing as follows: head ground colour entirely black, the subparafacial areas and interfrontal area velvety black and not paler than other parts of the head. Eyes even more strongly approximated, frons at narrowest point much narrower than third antennal segment (0·055 of head-width and about twice as wide as anterior ocellus), parafrontals contiguous for a considerable distance. Parafacials slightly narrower, at mid point a little less wide than antenna, totally bare. Arista long-plumose, hairs equally long on upper and lower surfaces and longest hairs much longer than width of frons at its narrowest point. Scutum pollinose only on about the posterior third. Wing with cell R_5 just closed at wing edge, vein M with bend slightly rounded rather than abrupt and nearer to wing edge than to *m–cu*. Abdomen with blackish brown ground colour extended forwards mid dorsally on T3 and T4 to form elongate triangles that just reach the anterior margin of the tergite; abdominal pollinosity mainly very pale greyish yellow, but darker yellowish brown close to the dark areas of the tergites; dorsal hairing of intermediate tergites long, fine and erect; apical half of T5 rather reddish. [Genitalia not examined.] Measurements: body length 6·6 mm, wing length 6·1 mm [1 specimen].

♀. Unknown.

MATERIAL EXAMINED. Holotype ♂, UGANDA: Bwamba valley, vii.1945 (*van Someren*), in British Museum (Natural History), London. (Holotype lacking left fore leg from the trochanter.)

AFFINITIES. This species is so close to *P. tachinoides* that the holotype (only specimen yet known) was found standing in the BMNH collection with the material of *tachinoides*. Nevertheless *P. paratachinoides* is certainly distinct, and can easily be differentiated from *tachinoides* at a glance by the strikingly plumose arista. Other distinctions will be clear from the foregoing key and description.

Phyto parafacialis sp. n.

DESCRIPTION. ♂. Ground colour of head blackish, except subparafacial areas dark reddish brown, head pollinosity silvery white; antennae black, palpi brownish. Head higher than broad, eye broadly suboval and slightly oblique, upper occiput flat. Eyes very strongly approximated, frons at narrowest point about equal in width to third antennal segment (0·08 of head-width), but interfrontal area not obliterated and distinctly visible on its whole height (parafrontals not meeting and reduced at narrowest point of frons to exceedingly narrow strips). Outer vertical setae, prevertical setae and proclinate orbital setae absent. Ocellar setae very long and strong, proclinate. Parafacials very narrow, at mid point not more than half as wide as antenna, the lower part only just visible in profile, with a very few small hairs on the upper half. Antennae medium-length, nearly reaching epistome, third segment about twice as long as second; arista long-pubescent (hairs on sub-basal part of dorsal surface almost short-plumosity). Proboscis very short, not nearly as long as head. Thorax brownish black; dorsum with thick silver-grey pollinosity on humeral calli and notopleura, and on a pair of vittae on the anterior part of the prescutum (the silvery paired prescutal vittae very conspicuous and positioned between the presutural *dc* and *acr* setae); pleural regions with thin greyish pollinosity. Two humeral setae. One pair of differentiated presutural *acr* setae. Two strong *post ia* setae, anterior one conspicuously closer to transverse suture than to posterior one. Two *stpl* setae. Pteropleural seta long and moderately strong. Barette with a single fine hair anteriorly [present both sides on the holotype, the only specimen available]. Infrasquamal hairs few, short and inconspicuous. Mesonotal hairing short, sparse and semi-recumbent. Scutellum with a pair of short weak basal setae and with lateral setae equidistant between scutellar base and apical setae. Legs black; claws very long. Fore tibia without submedian *pd* setae, with long fine *pd* preapical seta. Mid tibia with one *ad* seta. Hind tibia with two *ad* setae and two *av* setae. Wings almost hyaline (appearing *very* faintly brownish to naked eye); basicosta dirty yellowish; halteres yellow. Wing cell R_5 closed at wing edge and just basad of extreme wing tip; bend of M evenly curved and much closer to wing edge than to *m–cu*; *m–cu* about mid way between *r–m* and the bend, bent inwards medially but not obviously oblique in relation to M; basal node of R_{4+5} with one very long setula; costal spine very strong, rather more than twice as long as *r–m*. Calyptrae white, lower calypter faintly discoloured yellowish on outer part. Abdomen brownish black with fasciae of silvery grey pollinosity basally on T3, T4 and T5, the fasciae narrowly interrupted medially where the dark ground colour reaches the anterior margins of the tergites, the pale pollinosity occupying about the basal half of each tergite on the flanks. Abdominal T1 + 2 without median marginal setae, T3 with strong erect median marginals; T3–T5 each with a pair of erect median discal setae (those on T3 rather small); dorsal hairing of intermediate tergites very sparse, recumbent or semi-

recumbent. T7+8 forming a rather prominent knob in situ, epandrium extremely large, both with long setae. Cerci and surstyli long and narrow [ejaculatory sclerite not examined]. Measurements: body length 4·6 mm, wing length 4·0 mm [1 specimen].

♀. Unknown.

MATERIAL EXAMINED. Holotype ♂, SOUTH AFRICA: Natal, Durban, vii.1948 (*J. C. Faure*), in British Museum (Natural History), London. (Holotype lacking left mid and hind legs.)

AFFINITIES. Uncertain, and perhaps more closely with *Rhinomorinia* than with *Phyto* species. The appearance of the abdomen, and especially the very large epandrium and rather humped T7+8, are extremely like those of some South African species of *Rhinomorinia* such as *R. atra*, and I may be mistaken in placing *P. parafacialis* in *Phyto*. I do so, however, mainly on the grounds of *parafacialis* possessing a very large pre-alar seta like that of *Phyto* instead of the very small or non-existent pre-alar seta found in *Rhinomorinia*. Whether this character is as significant in Rhinophoridae as it seems is problematical. A notable feature of the new species, to which the specific name refers, is the very narrow parafacials; the lower parts of these are only just visible with the head seen in profile (a notable difference from other species of *Phyto* and from *Rhinomorinia* species).

Phyto stuckenbergi sp. n.

DESCRIPTION. ♀. Head ground colour black on posterior surface, vertex, parafrontals, parafacials and genal dilations, and yellow-orange to dark orange-red on interfrontal area, subparafacial areas and subocular strips; dark areas with pale yellowish grey pollinosity (not conspicuous); antennae dark brown except for some reddish or orange colouring apically on second segment and at extreme base of third; palpi blackish brown. Head shape generally similar to *P. longirostris* (Fig. 11) but epistome more prominent, eye subcircular, upper occiput distinctly swollen. Frons broad (about 0·37 of head-width), interfrontal area about twice as wide as a parafrontal. Outer vertical setae and prevertical setae present; proclinate orbital setae absent or represented by one or two small inconspicuous proclinate setulae on each side. Ocellar setae very strong, proclinate. Parafacials very broad, much wider than antenna, covered with short rather stiff hairs. Antennae of medium size, nearly reaching epistome, third segment slightly under twice as long as second segment; arista bare. Proboscis elongated but not strongly so, subequal in length to height of the head; palpi small, about as long as third antennal segment. Thorax black with rather even and thin greyish white pollinosity, virtually no pattern but trace of narrow black median paired lines on prescutum in some lights, the pollinosity inconspicuous. Two humeral setae. Two pairs of presutural *acr* setae (anterior one very weak). Two strong *post ia* setae (anterior one slightly closer to transverse suture than to posterior one). Two *stpl* setae. Pteropleural seta absent. Barette bare. Infrasquamal hairs few and minute, very inconspicuous. Scutellum without basal setae but with the lateral setae placed unusually high and very much closer to scutellar base than to apical setae. Legs black. Fore tibia without submedian *pd* setae, with a *pd* preapical seta. Mid tibia with one *ad* seta. Hind tibia with two *ad* setae and one *av* seta. Wings almost hyaline, appearing very faintly smoky to naked eye (especially apically); basicosta pale yellow; halteres pale reddish yellow. Wing venation as Fig. 24; basal node of R_{4+5} bare; costal spine absent. Calyptrae uniformly glassy white. Abdomen uniformly black and rather shining, with a coating of very inconspicuous thin greyish pollinosity (most evident laterally and ventrally). Abdominal T1+2 and T3 without median marginal setae, and tergites without strong discal setae, but sublateral parts of tergite hind margins and discs with some haphazardly developed short fine erect setae. Measurements: body length 5·2–5·8 mm, wing length 4·2–4·6 mm [2 specimens].

♂. Unknown.

MATERIAL EXAMINED. Holotype ♀, SOUTH AFRICA: Cape Province, Bredasdorp District, Arniston coastal dunes, 22–23.x.1964 (*B. & P. Stuckenberg*), in Natal Museum, Pietermaritzburg.

Paratype. 1 ♀, same data as holotype (BMNH).

AFFINITIES. See discussion under following species.

Phyto longirostris sp. n.

DESCRIPTION. ♀. Extremely similar to *P. stuckenbergi* described above but differing as follows: head shape as Fig. 11, epistome more weakly warped forwards from the face and vibrissal angles not very

prominent. Frons broader (about 0·43 of head-width), interfrontal area exceptionally large and about 2·6 times as wide as a parafrontal. Antennae heavier, third segment slightly longer in proportion to second. Proboscis very long and slender, its length greatly exceeding height of the head (Fig. 11). One pair of presutural *acr* setae (very strong). Apical scutellar setae directed straight upwards [this feature appears natural but only one specimen available]. Leg setae weaker, *pv* seta minute on one fore tibia and absent on the other in specimen seen. Wing with *m–cu* closer to bend than to *r–m* [extreme apices of holotype wings missing, petiolation if any of cell R_5 not known]. Measurements: body length 5·1 mm, wing length [estimated as wing tip missing] 4·5 mm [1 specimen].

♂. Unknown.

MATERIAL EXAMINED. Holotype ♀, SOUTH AFRICA: Cape Province, Cape Town, Table Mountain slopes above cable house, 24.ix.1959 (*B. & P. Stuckenberg*), in Natal Museum, Pietermaritzburg.

AFFINITIES. This species and *P. stuckenbergi* described above are exceedingly closely related to each other, but the relationships of both the species with other rhinophorids are very uncertain and even their assignment to the genus *Phyto* is only very doubtfully justified. They might better be placed in a new genus of their own when it becomes possible to integrate male characters and early stages into the classification. For the crude alphataxonomic purpose of getting the species described here, however, it seems best to consider the affinities as perhaps lying with *Phyto* species rather than with any other genus, and most of the characters (including the strong pre-alar seta) are those of *Phyto*. Both *stuckenbergi* and *longirostris* differ from other *Phyto* species rather obviously, however, in the head form, the profrontal region being rather strongly produced, the upper occiput rather distinctly swollen and the eyes somewhat subcircular. The elongation of the proboscis is unusual, and *P. longirostris* has a very much more attenuate proboscis than any other described rhinophorid (Fig. 11), although elongation approaching the same extent occurs in another South African species, namely *Rhinomorinia vittata* (Fig. 9). *P. stuckenbergi* and *P. longirostris* are also rather atypical for rhinophorids in the diminutiveness of the palpi, which do not attain to the length of the third antennal segment.

Genus *QUEXIMYIA* gen. n.

Type-species: *Queximyia flavipes* sp. n.

DIAGNOSIS. Head profile as Fig. 14. Eyes elongate-oval in outline, slightly oblique; gena well developed, its depth much greater than the antennal width. Epistome flat in the plane of the face, facial profile long and almost straight. Vibrissal angle sharp but not protruding, slightly less prominent than the profrons, vibrissae inserted well below the level of the lowermost point of the eye. Eyes of ♂ not approximated, frons equibroad in both sexes. ♂ without proclinate orbital setae [? constant], both sexes with prevertical setae and without outer vertical setae. Parafacials slightly narrower than antennae, well visible in profile, totally bare. Antennae long, antennal axis above level of eye middle, antennal apices reaching the epistome; arista long-pubescent. Proboscis very short. Pre-alar seta strong, much larger than notopleural setae. Presutural *acr* setae absent. Lower prostigmatic seta weak, hair-like, not proclinate. Pteropleural seta well developed. Barette bare. Apical scutellar setae strong, almost as large as lateral setae and crossing in proximal half. Mid tibia with one *ad* seta. Hind tibia with two *ad* setae, two *av* setae, a strong *pv* apical seta. Wing venation as Fig. 20: cell R_5 just closed at the wing apex; bend of vein M very widely obtuse and gently and evenly rounded; *m–cu* slightly bent but its general direction at right-angles to veins M and Cu_1; basal node of R_{4+5} setulose; costal spine differentiated (slightly longer than *r–m*). Abdomen with median discal setae on T3–T5; T1+2 without median marginal setae. ♂ genitalia with long narrow cerci and surstyli [distiphallus and ejaculatory sclerite not examined].

DISTRIBUTION. Known only from South Africa.

DISCUSSION. This genus is proposed for a previously undescribed South African species that differs from all other Afrotropical rhinophorids, and virtually all Eurasian forms also, in having exceptionally elongate antennae and some unusual and associated characteristics in the head shape. The profile of the lower margin of the head is unusually straight (Fig. 14) and the vibrissae are inserted about at the lowermost point of the head, whereas in almost all other rhinophorids the ventral profile of the head is curved or angulate and the vibrissae inserted well above the lowermost point of the head (cf., for example, Figs 8–12, 15–17). But so far as can be judged at

present the closest relationship of *Queximyia* is most probably with *Phyto*, with which there is a general agreement in many of the characters, for example the occurrence of a strong pre-alar seta and of median discal abdominal setae (although the new genus differs very obviously from *Phyto* in head structure). Regarding the exceptionally long antennae it may be noted that similarly attenuate antennae reaching to the vibrissae occur in the Oriental genus *Acompomintho*, but this genus has a very long-petiolate wing cell R_5, setose parafacials and reduced palpi, and lacks the pre-alar seta, and close affinity between *Queximyia* and *Acompomintho* is unlikely.

An unusual feature of *Queximyia* is that its included species is extensively reddish yellow on the thorax, abdomen and legs, unlike other rhinophorids in continental Africa and the great majority of rhinophorids in general in which body and legs are black.

Queximyia flavipes sp. n.

DESCRIPTION. ♂. Head ground colour black on frons, parafacials and occiput and reddish yellow on genae, postbuccae and epistome; antennae and arista blackish brown, except second antennal segment and extreme base of third largely reddish orange; palpi yellow, mentum tawny yellow. Parafacials, lower parts of parafrontals and a large area on the postvertex bright silver pollinose; lower parts of head white pollinose, upper parts of parafrontals semi-shining. Head shape much as in ♀ (Fig. 14) but antennae longer and heavier. Ocellar setae weak and proclinate. Lowermost third of facial ridges weakly haired; vibrissae *very* strong. Genal dilation well developed, with sparse long hairs and without strong peristomal setae. Upper occiput hardly at all swollen, wholly bare behind postocular row. Third antennal segment four times as long as second; arista thickened on basal quarter. Thoracic dorsum (including all of the scutellum) blackish brown except for some reddish colouring on humeral calli and supra-alar regions; pleural regions entirely reddish yellow. Prescutum and scutum with a broad silvery pollinose median vitta between the *dc* rows of setae, the vitta single presuturally but subdivided by a fine median dark brown line postsuturally; humeral calli and notopleura with moderately conspicuous silvery pollinosity, pleural regions with very thin inconspicuous whitish pollinosity. Two *stpl* setae (very strong). Infrasquamal hairs few and fine. Scutellum without differentiated setae in addition to the strong lateral and apical setae. Legs reddish yellow with black tarsi; claws long. Wings very pale brownish; halteres yellow. Wing venation as Fig. 20. Calyptrae pale translucent yellowish. Abdomen reddish yellow laterally on T1+2, T3 and T4, broadly brownish black on the dorsum of these tergites and on more or less the whole of T5 and the visible postabdomen; dorsal dark band slightly narrowed at extreme bases of T3 and T4 and yellow colouring here extending closer to mid-line; T3–T5 each with a narrow band of pure white pollinosity basally, the pollen most conspicuous laterally in some lights, black postabdomen strongly shining. T3 without median marginal setae (as T1+2); abdominal hairing long and recumbent, not dense. T7+8 just visible in situ; epandrium enlarged and rotund, bearing many long fine setae. Lobes of sternite 5 very large, downwardly prominent, reddish orange coloured. Measurements: body length 5·9 mm, wing length 4·6 mm [1 specimen].

♀. Very like ♂ but with more extensive reddish yellow ground colour on sides of the prescutum and scutum and at the base of the third antennal segment, and with some reddish ground colour underlying the median silvery pollinose vitta of the thoracic dorsum. Frons with more strongly differentiated metallic and pollinose areas than in ♂, inner parts of parafrontals shining black and very strongly contrasting with silver pollinose outer parts. Antennae shorter and slimmer than in ♂, third segment about 3·3 times as long as second segment. Interfrontal area dark reddish brown. Wing length 4·8 mm [1 specimen].

MATERIAL EXAMINED. Holotype ♂, SOUTH AFRICA: Natal, Durban, Stella bush, 17.x.1931 (*Miss A. Mackie*), in British Museum (Natural History), London.

Paratype. SOUTH AFRICA: 1 ♀, Natal, Durban, Umbilo, 31.vii.1919 (*A. L. Bevis*) (BMNH).

NOTES. This species is so distinctive that it has been described despite the imperfect condition of the type-material. The holotype has the head capsule cracked, a tear in the right wing and lacks the left fore leg; the paratype has the abdomen gummed to the data label and lacks both hind legs and most of the right wing.

Genus *COMOROMYIA* gen. n.

Type-species: *Comoromyia griseithorax* sp. n.

DIAGNOSIS. Eyes elongate-suboval in outline, very slightly oblique; gena moderately large, its depth

greater than the antennal width. Epistome warping slightly forwards from the face, facial profile weakly concave. Vibrissal angles moderately sharp, a little less prominent than the profrons, vibrissae inserted slightly below the lowermost point of the eye but well above lowermost point of the head. Parafacials narrower than antennae but just visible in profile, totally bare. Antennae of medium length and nearly reaching the epistome, antennal axis well below eye middle; arista bare. Proboscis very short. Pre-alar seta strong, much larger than notopleural setae. Presutural *acr* setae present (one very weak pair differentiated). Lower prostigmatic seta hair-like and proclinate. Pteropleural seta hair-like. Barette bare. Apical scutellar setae moderately strong, crossing in apical half, about two-thirds as long as lateral setae (latter placed higher than usual on sides of scutellum). Mid tibia with one *ad* seta. Hind tibia with one *ad* seta, one *av* seta and a very strong *pv* apical seta. Wing venation as Fig. 18: cell R_5 closed and with long petiole subequal in length to *m–cu*; bend of vein *M* strongly angulate, changing direction at about 100°, but actual point at which bend occurs rather rounded; *m–cu* almost straight, at right-angles to *M* but obtuse in relation to last section of Cu_1; basal node of R_{4+5} with one long setula; costal spine undifferentiated. Abdomen without discal setae; T1 + 2 without median marginal setae.

DISTRIBUTION. Known only from Comoro Islands.

DISCUSSION. The foregoing diagnosis is based only on the female sex, the male being unknown. Ordinarily I should hesitate to describe a new genus on one sex only, but in the present case it appears justified as the appearance of the female is very distinctive and there should be no difficulty in correlating the male at a later date. One female of *Comoromyia* is to hand, namely the holotype of the new species *Comoromyia griseithorax* described below. This specimen was collected by Mr Loïc Matile on a recent visit to the Comoro Islands and is the only specimen of Rhinophoridae yet known from any of the Indian Ocean islands.

The new species does not fit satisfactorily in any described genus and in the absence of the male it is hard to assess the possible affinities. The strong pre-alar seta and general facies suggest a relationship with *Phyto*, but the head form and wing venation do not justify squeezing *griseithorax* into this or any other related genus already described. The wing venation and bare parafacials recall the European genus *Paykullia* (syn. *Chaetostevenia*), but total facies and the large pre-alar seta make it inappropriate to assign the new Comoro Island species to this genus.

The total appearance of *C. griseithorax* is rather muscid-like, the uniformly ashy grey thorax and the form and bristling of the head being reminiscent of some Coenosiinae.

Comoromyia griseithorax sp. n.

DESCRIPTION. ♀. Head ground colour blackish on the frons, parafacials and posterior surface (including the genal dilations), brownish on the face and epistome, and reddish orange on the subtriangular area between genal dilations and parafacial; antennae brown except for yellowish orange bases of the third segments; palpi yellow. Parafrontals pale ashy grey pollinose (pale colour strongly contrasting with velvety black interfrontal area), posterior surface of head ashy grey pollinose, facial regions white pollinose. Outer vertical setae absent, prevertical setae directed backwards rather than outwards, two pairs of proclinate orbital setae [holotype, the only specimen, with the lower proclinate orbital seta of one side very weak]. Ocellar setae small and proclinate. Parafrontals very sparsely haired. Vibrissae strong, exactly level with epistome. Genal dilation well developed, anteroventral corner with a rather strong peristomal seta. Third antennal segment 2·5 times as long as second; arista thickened on basal fifth. Thorax with blackish ground colour and uniformly and rather thickly pale ashy grey pollinose. Two *stpl* setae (both very strong). Second *sa* seta absent. Infrasquamal hairs few, minute. Scutellum without differentiated setae in addition to the lateral and apical pairs. Legs mainly reddish yellow, but tarsi blackish, fore femora largely brownish, mid and hind femora indefinitely darkened preapically, coxae partially brownish or blackish under the pollinosity; claws medium-sized. Wings very faintly yellowish brown infuscate, especially near veins; halteres pale creamy yellowish. Wing venation as Fig. 18. Calyptrae translucent medially and faintly yellowish peripherally. Abdomen tawny reddish yellow with indefinite reddish brown darkening medially, T5 more blackish brown, hind margins of tergites very narrowly paler yellow; abdominal dorsum with trace of very thin whitish pollinosity seen at some angles. T3 without median marginal setae (as T1 + 2); abdominal hairing long and recumbent. Measurements: body length 5·6 mm, wing length 5·0 mm [1 specimen].

♂. Unknown.

Material examined. Holotype ♀, Comoro Islands: Anjouan, Col de Moya, 850 m, 16.i.1974 (*L. Matile*), in Muséum National d'Histoire Naturelle, Paris. (The holotype lacks the right hind leg from the trochanter and the right mid leg from the femur, and has a tear in the right wing, but is otherwise complete.)

Genus *STEVENIA* Robineau-Desvoidy

Stevenia Robineau-Desvoidy, 1830 : 220. Type-species: *Stevenia tomentosa* Robineau-Desvoidy, 1830 [= *Tachina atramentaria* Meigen, 1824], by designation of Robineau-Desvoidy (1863 (2) : 378).
Eophyto Townsend, 1919*a* : 163. Type-species: *Eophyto ceylanica* Townsend, 1919, by original designation. **Syn. n.**
Other synonyms: several other generic synonyms (see Herting, 1961).

Diagnosis. Head shape varied but profile typically much as Fig. 15. Eyes narrowly to broadly suboval in outline, slightly oblique; gena moderately large, its depth much greater than antennal width. Epistome weakly warped forwards from the face, facial profile very slightly to moderately concave. Vibrissal angles very weak to moderately strong, usually less prominent than the profrons but occasionally about equally so, vibrissae inserted below lowermost point of the eye but well above lowermost point of the head. Eyes of ♂ either wide apart and frons equibroad with ♀, or partially approximated so that ♂ frons narrower than ♀ (if ♂ eyes approximated then *not* to the extent that interfrontal area is obliterated or prevertical setae lost). ♂ with or without proclinate orbital setae, ♂ and ♀ with prevertical setae (sometimes two pairs and often reclinate instead of directed outwards), both sexes with or without outer vertical setae. Parafacials of varied width but well visible in profile, haired and with some very strong setae (latter proclinate and usually on lower half of parafacial only). Antennae small or medium-sized, falling short of epistome, antennal axis at or below level of eye middle; arista bare to long-pubescent. Proboscis short, not longer than head. Pre-alar seta very weak or virtually absent, much smaller than notopleural setae. Presutural *acr* setae usually present but occasionally very weak or one of the usual pair missing. Lower prostigmatic seta weak or hair-like, directed outwards or downwards. Pteropleural seta weakly differentiated. Apical scutellar setae strong and almost as large as lateral setae, usually crossing near the middle; scutellum most often with a pair of small basal setae in addition. Mid tibia with two or more *ad* setae. Hind tibia with two or more *ad* setae, two or three *av* setae, and with a strong *pv* apical seta. Wing venation as or similar to Fig. 26: cell R_5 closed well before wing margin and long-petiolate, the petiole about as long as or longer than *m–cu* (except for *S. acutangula* Villeneuve in which less than half as long as *m–cu*); bend of vein *M* very abrupt, direction changing at about 90–115° (except in *acutangula* in which widely obtuse); *m–cu* straight or weakly sinuous, at right-angles to or slightly oblique in relation to *M*; basal node of R_{4+5} setulose; costal spine strong. Abdomen with or without discal setae; abdominal T1 + 2 with or without median marginal setae. ♂ genitalia with elongate narrow cerci and surstyli (latter longer than former in species examined); ejaculatory sclerite small and subspatulate at each end or rather large and fan-shaped.

Distribution. Palaearctic Region, Socotra and Sri Lanka (Ceylon). Best represented through the Mediterranean subregion (including North Africa) to the Middle East and southern U.S.S.R. but occurring in Europe northwards to southern England and southern Scandinavia. Unknown from Canary Islands and Madeira.

Hosts and early stages. *Stevenia atramentaria* reported as a parasite of the woodlouse *Porcellio scaber* L. by Thompson (1934, as 'Species B' unnamed with 'B' now determined by Bedding (1973 : 28) to be *atramentaria*). This species also listed as a parasite on woodlice of the genera *Philoscia* Latreille and *Tracheoniscus* Verhoeff by Herting (1961 : 3) and the genus *Stevenia* listed as parasitizing *Oniscus* L. woodlice by van Emden (1954 : 10), but neither author citing supporting references. Early stages of *atramentaria* described by Thompson (1934, as 'Species B') and Bedding (1973).

Discussion. This is one of the largest rhinophorid genera, being about equal in number of species to *Phyto* and including thirteen species in Herting's (1961) treatment. Up to now the genus has been known only from the Palaearctic Region, but a species occurs in the island of Socotra in the Afrotropical Region and another in Sri Lanka (Ceylon). The Socotran species is newly described below on the basis of some specimens that have stood unnamed for many years in the BMNH collection and that certainly represent a new species distinct from any of those known in the

Palaearctic Region (Dr Herting has kindly confirmed my opinion that the species has not previously been described).

The species from Sri Lanka is known only from one specimen, the female holotype of *Eophyto ceylanica* Townsend and the nomenclatural basis of Townsend's (1919*a*) monotypic genus *Eophyto*. This specimen, from the United States National Museum, has been examined and found to be generically indistinguishable from *Stevenia*, although specifically it is certainly the basis of a valid name. *Stevenia* is the most distinctive genus of Rhinophoridae, being easily recognized by the strong setae on the parafacials in combination with the long-petiolate wing cell R_5, together with a number of other features such as 2(+) *ad* setae on the mid tibia, 2(+) *av* setae on the hind tibia, and a small pre-alar seta, and *Eophyto* has all of these *Stevenia* characters. I therefore see no justification for maintaining *Eophyto* as a valid genus and here sink the name into new synonymy with *Stevenia*. The *ceylanica* holotype has the hind cross-vein *m–cu* less oblique than is typical and nearer than normal to cross-vein *r–m*, and has the parafacial setae forming a row down most of the parafacial (rather than confined to the lower half), but these features seem to me to be of specific value only, and too insignificant to use to separate *Eophyto* from *Stevenia*. Indeed, the whole facies of *ceylanica* is essentially that of *Stevenia*: the male of *ceylanica* being unknown, however, it has to be presumed that the male genitalia of this species will conform in general structure to those of *Stevenia* in general.

Here it may be noted that I have examined the male genitalia of *Stevenia socotrensis*, *S. atramentaria* and *S. umbratica* (Fallén) and all have very similar long forwardly curving surstyli and much shorter pointed cerci. The ejaculatory sclerite is more variable, and in *atramentaria* is a rather large and conspicuous fan-shaped structure that is rather pale and weakly sclerotized.

S. atramentaria is here considered to be the type-species of *Stevenia*, in accordance with Herting's (1974 : 33) revised opinion that the nominal type-species (*S. tomentosa*) is synonymous with *atramentaria* and not with *S. umbratica* as had been accepted in the past – for example, by Townsend (1938 : 204) and by Herting (1961 : 21) himself.

The new species of *Stevenia* from Socotra is described below.

Stevenia socotrensis sp. n.

DESCRIPTION. ♂. Head blackish with thin inconspicuous whitish pollinosity, the parafrontals rather shining; area between genae and parafacials, and sometimes the interfrontal area more reddish than elsewhere; antennae mainly dark brown, but reddish orange apically on the second segment and basally on the third; palpi dark brown. Head shape as Fig. 15. Eyes hardly at all approximated, but frons slightly narrower than in ♀; interfrontal area subequal in width to a parafrontal. Outer vertical setae absent, one or two pairs of strong prevertical setae (directed slightly outwards), one pair of strong proclinate orbital setae (haphazardly accompanied by a weak second proclinate orbital seta on one side or both). Ocellar setae almost hair-like. Parafacial setae with about four main setae in the series. Upper occiput weakly swollen, with sparse black setulae. Genae with very long strong hairing. Third antennal segment about 1·2 times as long as second; arista thickened on about basal quarter, almost bare. Thorax black, very thinly whitish pollinose, dorsum virtually without vittae and pleural regions shining. Two pairs of presutural *acr* setae. Two or three *stpl* setae (lower anterior one not always differentiated). Second *sa* seta absent or represented by a hair. Infrasquamal hairs absent or very sparse. Scutellum with lateral setae standing closer to scutellar base than to apical setae, and without trace of basal setae. Legs black; claws of moderate length, about as long as last tarsal segment. Femora and tibiae without modified hairing or spinules; fore tibia with a strong submedian *pd* seta and with *pd* preapical seta; mid tibia with two *ad* setae; hind tibia with two *ad* setae. Wings pale brownish, colouring most intense anteriorly and very faint posteriorly; basicosta reddish yellow; halteres pale brownish. Wing venation as Fig. 26: base of R_{4+5} with long fine setulae in a series extending from the node for about three-quarters of the distance to *r–m*; costal spine moderately strong, slightly longer than *r–m*. Calyptrae whitish or very pale dingy brownish. Abdomen black with fasciae of greyish white pollinosity on about basal third or two-fifths of tergites 3, 4 and 5. Abdominal T1+2 and T3 each with a pair of strong erect median marginal setae; T3 with one pair of median discal setae, T4 with one or more pairs of median discals, and T5 with a transverse row of discal setae. Postabdomen with T6 very small and rather weakly sclerotized, T7+8 and epandrium without strong setae (only with long hairing). ♂ genitalia with surstyli long, attenuate and rather strongly curved forwards seen in profile; cerci elongate but much shorter than surstyli, pointed

in profile and bluntly rounded in apical view; ejaculatory sclerite medium-sized, broad and widening at each end. Measurements: body length 4·9–5·0 mm, wing length 4·1 mm [2 specimens].

♀. Similar to ♂ but frons slightly wider and abdomen entirely shining (without evident bands of pollinosity on T3–T5); discal setae of T3 and T4 much weaker than in ♂, and tarsal claws shorter. Measurements: body length 3·8–4·1 mm, wing length 3·1–3·5 mm [2 specimens].

MATERIAL EXAMINED. Holotype ♂, SOCOTRA: Adho, Diemellus, 1100 m [3500 ft], 15.ii.1899 (*W. R. O. Grant*), in British Museum (Natural History), London.

Paratypes. 2 ♂, 2 ♀, data and depository as for holotype.

AFFINITIES. *Stevenia socotrensis* has a combination of characters cutting across those of other species, and it is difficult to suggest particular affinity with a Palaearctic form. If run in Herting's (1961) key to species *socotrensis* will not pass the second couplet because it shows the presence in combination of median marginal setae on T1+2, presutural *acr* setae and two *or* three *stpl* setae. On balance it appears fairly close to the type-species, *S. atramentaria*, and the genitalia are closely similar to those of this species; but it differs considerably from *atramentaria* in general appearance, less extensive bristling (only two *ad* setae on the hind tibia, for example), presence of proclinate orbital setae in the ♂, wider ♂ frons, and in the extent of setulae along the basal part of vein R_{4+5}. The last-mentioned character recalls *S. umbratica*, in which setulae extend at least halfway to *r–m*, and the head shape of *socotrensis* (with presence of proclinate orbital setae in both sexes) is also *umbratica*-like, but *socotrensis* has abdominal discal setae (absent in *umbratica*), fewer leg setae and no spiniform vestiture at the apex of the *pv* surface of the ♂ mid femur. *S. socotrensis* differs from both *umbratica* and *atramentaria* in having the lateral scutellar setae conspicuously nearer to the base of the scutellum than to the apical setae.

Genus *MELANOPHORA* Meigen

Melanophora Meigen, 1803 : 279. Type-species: *Musca grossificationis* Linnaeus, 1758 [=*Musca roralis* Linnaeus, 1758], by monotypy.

Illigeria Robineau-Desvoidy, 1830 : 273. Type-species: *Illigeria atra* Robineau-Desvoidy, 1830 [=*Musca roralis* Linnaeus, 1758], by designation of Townsend (1916 : 7).

DIAGNOSIS. Head profile as Fig. 17. Eyes broadly ovate, slightly oblique; gena very large, its depth several times greater than antennal width and more than half eye height. Epistome slightly warped forwards from the face, facial profile weakly concave. Vibrissal angles poorly defined and much less prominent than profrons, vibrissae inserted far below lowermost point of the eye. Eyes of ♂ not approximated, frons equibroad in both sexes. ♂ and ♀ with proclinate orbital setae, prevertical setae and outer vertical setae. Parafacials wider than antennae and well visible in profile, bare or with some fine hair on upper parts. Antennae extremely small and falling short of the epistome, antennal axis far below eye middle (scarcely above lowermost point of the eye); arista micropubescent or long-pubescent. Proboscis very short. Pre-alar seta absent. Presutural *acr* setae absent. Lower prostigmatic seta moderately strong, proclinate or slightly so. Pteropleural seta weak or undifferentiated. Barette bare. Apical scutellar setae very weak, about half as long as lateral setae or less, usually crossing near their apices. Mid tibia with one *ad* seta (very small). Hind tibia with one or two *ad* setae (very small), with one *av* seta and with small *pv* apical seta. Wing venation as Fig. 25: cell R_5 closed far from wing margin and with very long petiole; bend of vein *M* not widely obtuse (about 110–115°), usually abruptly angulate but sometimes rounded (especially in ♀); *m–cu* nearly straight and about at right-angles to veins *M* and Cu_1; basal node of R_{4+5} setulose; costal spine undifferentiated. Abdomen without discal setae; T1+2 with median marginal setae. ♂ genitalia with pointed narrow cerci and broadly rounded surstyli of subequal length, ejaculatory sclerite strongly spatulate.

DISTRIBUTION. Western Palaearctic Region, including the British Isles and North Africa. Occurring also in the eastern United States, Jamaica and Brazil, but possibly as a recent immigrant from Europe. Present in Cape Verde Islands but apparently unrecorded from Canary Islands and Madeira.

HOSTS AND EARLY STAGES. The one known species parasitic on woodlice of the genus *Porcellio* Latreille in Europe (Thompson, 1934) and North America (Brues, 1903), and of the genus

Armadillidium Brandt & Ratzeburg in Brazil (Parker, 1953). Early stages described by Bedding (1973), Parker (1953) and Thompson (1934).

Discussion. This genus is monotypic, including only *M. roralis*, and finds a place in the coverage of the present work only because this species occurs in the Cape Verde Islands. Specimens of *roralis* from the Cape Verde Islands are present in the BMNH collection, and Herting (1958) has already recorded the species from this locality.

Melanophora roralis (Linnaeus)

Musca roralis Linnaeus, 1758 : 597. Holotype ♀, Europe (Linnean Society, London) [examined].
Musca grossificationis Linnaeus, 1758 : 599. Holotype ♀, Europe (Linnean Society, London) [examined].
Musca interventum Harris, 1780 [not 1776] : 144 (pl. 42, fig. 57). Type(s), Great Britain: England (lost).
Tachina interlapsa Walker, 1853 : 37. Type(s), Great Britain: England (lost).
Other synonyms: numerous other synonyms, see Guimarães (1971) and Herting (1974; 1976).

Description. ♂. Head, antennae and palpi brownish black. Head shape as Fig. 17 and in detail as illustrated by Thompson (1934 : fig. II, 2). Frons with about six pairs of strong proclinate orbital setae. Ocellar setae moderately developed, proclinate. Upper occiput not swollen, bare behind the postocular row. Third antennal segment *very* small and rounded, equal in length to second. Thorax black and semi-shining, without evident pollinosity. Three *stpl* setae, but anteroventral one sometimes hair-like. Infra-squamal hairs absent or very few and minute. Legs black; claws very small, much shorter than last tarsal segment. Wings brown, the infuscation weakening slightly and evenly towards the hind margin; halteres black. Wing venation as Fig. 25. Calyptrae pale brownish. Abdomen entirely shining black, without pollinosity; abdominal hairing short, dense and recumbent. Measurements: body length 4·0–7·1 mm, wing length 3·3–5·5 mm.

♀. Very like ♂ but differing by having much shorter hairing on the arista, the apex of the wing abruptly milky white behind the petiole (as figured by Thompson (1934 : 385)), and the abdomen strongly pointed. Size range about as for ♂.

Material examined. Holotype ♀ of *roralis*, Europe (no other data), in Linnean Society, London. Holotype ♀ of *grossificationis*, Europe (no other data), in Linnean Society, London. (*roralis* holotype in fair condition except for loss of left mid leg and apices of some tarsi; *grossificationis* holotype pressed flat on paper mount bearing ink number '1051' correlating with Linnaeus's published 'Fn. Suec.' number, legs lost except one fore leg.)

Cape Verde Islands: 3 ♂, St Vincent, 13.iv.1896 (*O. Thomas*) (BMNH). 121 ♂ & ♀, various localities in Great Britain: England, Europe, Algeria, North America, Jamaica and Brazil (BMNH).

Distribution. The material seen reflects the distribution of *Melanophora roralis*, the species occurring throughout Europe and in Palaearctic Africa, and in some eastern parts of the New World. The species is known from three islands of the Cape Verde group, the BMNH material confirming its presence in São Vicente, and Herting's (1958) record confirming its presence in Santo Antão and Brava (material from Herting's record in Zoological Museum, Helsinki).

Genus ***PARAZAMIMUS*** Verbeke

Parazamimus Verbeke, 1962 : 164. Type-species: *Parazamimus congolensis* Verbeke, 1962, by original designation.

Diagnosis. Head profile as Fig. 30. Eyes broadly rounded, slightly oblique; gena extremely large, its depth greater than *length* of third antennal segment and more than half eye-height. Epistome very slightly warped forwards, facial profile very weakly concave. Vibrissal angles poorly defined but about equal in prominence to profrons, vibrissae inserted below lowermost point of the eye. Eyes of ♂ not approximated. ♂ with proclinate orbital setae, prevertical setae and outer vertical setae. Parafacials narrower than antennae, narrowly visible in profile and finely haired. Antennae minute and not nearly reaching epistome, antennal axis just below eye middle; arista thickened only at extreme base, exceedingly fine and bare. Proboscis very short, in rather small oral cavity. Pre-alar seta absent. Presutural *acr* setae absent. Lower prostigmatic seta absent. Pteropleural seta undifferentiated. Barette bare or with a very few hairs. Apical

scutellar setae strong and convergent, equal in size to lateral setae, laterals inserted much closer to scutellar base than to apical setae. Mid tibia with one *ad* seta. Hind tibia with two *ad* setae, two *av* setae and a *pv* apical seta. Wing venation as Fig. 29: cell R_5 just closed at wing apex; bend of vein *M* very widely obtuse and gently rounded; *m–cu* nearly straight and about at right-angles to vein *M*; basal node of R_{4+5} with one fine setula; costal spine undifferentiated. Abdomen without discal setae; T1+2 without median marginal setae. ♂ genitalia with short cerci and surstyli of subequal length, ejaculatory sclerite large and fan-shaped.

Distribution. Known only from Zaire.

Discussion. This genus is still known only from the male holotype of *P. congolensis*, and the foregoing diagnosis might need adjustment when the female becomes known; it is likely, however, that the female will be closely similar to the male. The relationships of *Parazamimus* are obscure, and it is not certain that it is correctly placed in Rhinophoridae, as Verbeke stated in the description ('Affinités incertaines; appartient probablement aux Rhinophoridae'), but the genus fits quite well to the definition of Rhinophoridae given in this paper on all its external features and I accept *Parazamimus* as a rhinophorid for present purposes. The distiphallus of the aedeagus, however, is extremely similar to that of many Calliphoridae and if not a rhinophorid then *Parazamimus* must certainly belong in the Calliphoridae (the slide-mounts of the ♂ genitalia of *congolensis* made by Verbeke have been examined and the distiphallus found to be extremely accurately figured by Verbeke, pl. 12, fig. 9). Verbeke compared *Parazamimus* to '*Reichardia*', but this was due to a complete misunderstanding of *Reichardia* Karsch which is a tachinid genus in the Voriini, and '*Reichardia insignis* Karsch' sense of Verbeke is actually *Bequaertiana* (see next genus). Some interesting resemblances exist between *Bequaertiana* and *Parazamimus* and these are discussed in more detail under the treatment of the former.

Parazamimus congolensis Verbeke

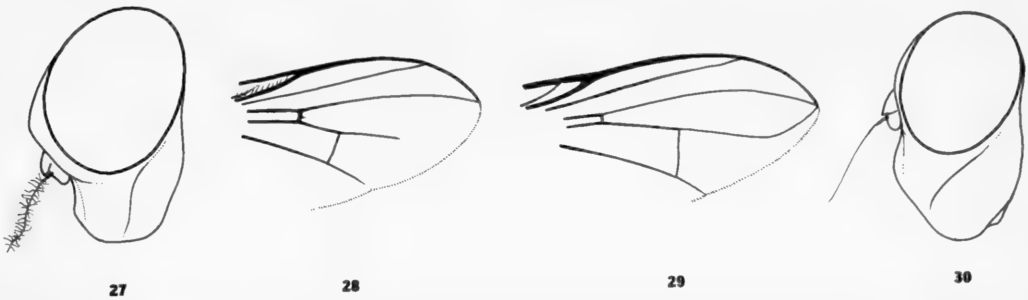
Parazamimus congolensis Verbeke, 1962 : 164. Holotype ♂, Zaire (IRSNB, Brussels) [examined].

Description. ♂. Head ground colour reddish; antennae reddish orange; palpi reddish yellow. Head shape as Fig. 30. Frons very wide, about 0·38 of head-width. Two pairs of strong proclinate orbital setae. One pair of strong prevertical setae. Vibrissae strong and crossed, facial ridges above vibrissae rather strongly swollen and with long hair. Upper occiput apparently mainly bare behind postocular row. Antennae with second segment conspicuously large and third segment extremely small and orbicular (shorter than second segment). Thorax entirely reddish yellow. Two humeral setae [but inner one a minute hair on one side in holotype]. Posterior notopleural seta much weaker than anterior one. 0+1(2) *acr* setae. 2+3 *dc* setae [holotype with fine setula preceding *prst dc* setae]. 0+2 *ia* setae (the *post ia* setae unusually close to each other and rather remote from transverse suture). Second *sa* seta absent. Prosternum and propleuron bare. Two *stpl* setae. Infrasquamal hairs present, long and fine. Legs reddish yellow (tarsi appearing darker apically because of black hairing); claws very short. Fore coxa bare on inner anterior surface. Fore tibia with two very small *pv* setae. Mid tibia with the *p* and *pd* setae minute (inconspicuous and hardly more than setulae). Hind tibia with two *pd* setae (additional to setae mentioned under genus). Wings long for body size, almost hyaline (very faint trace of yellowish brown colour in some lights); basicosta reddish yellow; halteres yellowish. Bend of vein *M* very close to wing edge; *m–cu* slightly closer to *r–m* than to bend, second costal sector about two-thirds as long as *m–cu*. Wing membrane with exceptionally long microtrichia giving the wings a hairy appearance, costal vestiture entirely hair-like, second and third costal sectors closely haired ventrally. Calyptrae whitish, rather tongue-like with the side margins almost straight and subparallel and the apical part of the margin evenly rounded. Abdomen reddish yellow basally and slightly darkening to reddish posteriorly, without markings. T3–T5 each with full series of marginal setae, but these weak and unusually recumbent on T3; abdominal hairing fine and recumbent. Sternites widely exposed, sternite 5 deeply bifid with evenly rounded lateral lobes. Cerci in apical view broad basally and sharply contracted to narrow apices, surstyli rather broad and with evenly rounded tips (Fig. 37), distiphallus as figured by Verbeke (1962 : pl. 12, fig. 9). Measurements: body length *c.* 7·0 mm, wing length 6·3 mm [1 specimen].

♀. Unknown.

Material examined. Holotype ♂ [genitalia slide-mounted], Zaire: Kivu, Goma, 16.v.1953 (*J. Verbeke*, KEA), in Institut royal des Sciences naturelles de Belgique. (Holotype not in good

condition. Body entirely greased (? with thin pollinose lines on mesonotum), head loose on a micro-pin driven through the thorax and abdomen and emerging mid-dorsally on T4, left fore leg and right mid leg lost, right fore leg gummed to polyporus mount. Verbeke gives length as 6 mm and wing length as 5·5 mm but my measurements by eyepiece micrometer are larger – body without head being exactly 6 mm.)



Figs 27–30 Head profiles in outline, and wings, of (27 & 28) *Bequaertiana argyriventris* and (29 & 30) *Parazamimus congolensis.*

Genus *BEQUAERTIANA* Curran

Bequaertiana Curran, 1929 : 14. Type-species: *Bequaertiana argyriventris* Curran, 1929, by original designation.
[*Reichardia* Karsch sensu Verbeke, 1962 : 130, 164, pl. XII. Misidentification.]

Diagnosis. Head profile as Fig. 27. Eyes subcircular in outline; gena extremely large, its depth much greater than *length* of antennae and more than half eye-height. Epistome gradually warped forwards from deeply excavate face, facial profile slightly concave. Vibrissal angles very blunt and poorly defined, recessive in relation to profrons and approximated to each other so that epistome reduced to unusually narrow strip, vibrissae inserted *far* below lowermost point of eye and not much above lowermost point of head. Eyes of ♂ widely separated. ♂ with proclinate orbital setae, prevertical setae and outer vertical setae. Parafacials about as wide as antennae, well visible in profile and strongly haired. Antennae extremely small and not nearly reaching epistome, antennal axis far below eye middle; arista strongly and irregularly plumose on its length. Proboscis atrophied in extremely small subcircular oral cavity. Prealar seta absent. Presutural *acr* setae absent. Intra-alar setae absent. Lower prostigmatic seta absent or represented by minute hair. Pteropleural seta absent (and pteropleuron totally bare). Barette bare. Scutellum with only one pair of definite marginal setae (divergent or subparallel and standing in subapical position). Tibiae without setae (at most with setae represented by minute setulae, even at tibial apices). Wing venation as Fig. 28: apical section of vein *M* and the bend of *M* missing (i.e. M_1 absent and cell R_5 not closed posteriorly); *m–cu* straight and at right-angles to vein *M*; basal node of R_{4+5} bare or with fine setulae; R_1 strongly haired along its length; subcosta evanescent apically and costal break virtually absent, no costal spine and costal vestiture entirely hair-like. Abdomen entirely without setae (only sparse hairing). Sternites (♂) widely exposed, sternite 5 bifid with simple lobes. ♂ genitalia with cerci fused into a small subquadrate plate, surstyli long but stout and rounded apically.

Distribution. Tropical African forest areas, known from Liberia, Zaire, Uganda and Rwanda.

Discussion. This is one of the most aberrant genera to be found in the calyptrate flies, and Zumpt (1956 : 176) has gone so far as to state unequivocally that 'It certainly does not belong to the Calyptrata, but to an acalyptrate family near the Lonchaeidae'. Unfortunately Zumpt gives no reasons for this view, which is completely counter to that of the few other dipterists who have seen the genus. Curran (1929) and Townsend (1935, 1938) assigned *Bequaertiana* to the Moriniinae and Melanophorini respectively (i.e. to groups now treated as rhinophorids), and Peris (1957) treated it as part of Rhinophorinae. I am not convinced, despite the likeness of the head to *Melanophora*, that *Bequaertiana* is rightly placed in the Rhinophoridae (especially as the fusion of the cerci of the male genitalia does not occur elsewhere in rhinophorids) but am leaving it in this family until its real affinities can be better determined from discovery of the female, the early stages and the host relations (all at present unknown: parasitic biology presumed). If not a

rhinophorid, then it should probably be assigned to the Calliphoridae, and it is noteworthy that the fused cerci are reminiscent of a similar genitalic condition occurring in several calliphorids. There is certainly nothing in my opinion to support Zumpt's suggestion that *Bequaertiana* is an acalyptrate, for it shows in combination most of the classic characters of a calyptrate fly (possessing, for instance, a transverse suture or impression on the mesonotum, numerous setae on the frons, well-developed lower calyptrae and very narrow strip of pleural membrane); only the bristle-less tibiae and the lack of a definite subcostal 'break' in the costa are reminiscent of some acalyptrates.

It is very likely that *Bequaertiana* is a highly apomorphic derivative from a *Parazamimus*-like ancestral form, and if it can be convincingly shown that *Parazamimus* is a rhinophorid then almost certainly *Bequaertiana* is too. The widely dichoptic ♂ heads of the two genera are essentially similar, with minute antennae in a deeply excavate face, rounded eyes and deep gena, and with non-prominent vibrissal angles, but in *Bequaertiana* there is an even more reduced oral cavity than in *Parazamimus* (with obviously non-functional vestigial mouthparts) and the epistome has become very restricted by inward approximation towards each other of the vibrissal angles. The wings are superficially different because of the loss of M_1 in *Bequaertiana*, but actually show a very telling resemblance, as in both genera there is almost no break in the costa near the end of *Sc*, the costa lacks the usual spinules and instead has a vestiture composed solely of uniform strong hairing, and the wing membrane has unusually strong microtrichia (giving the wings a rather 'hairy' appearance, especially in *Parazamimus*). The lower calyptrae also show a resemblance: in both they are longer than is usual in rhinophorids with the sides rather straight, but in *Bequaertiana* they are even longer and more tongue-like than is *Parazamimus*.

Apart from these characters *Bequaertiana* differs from *Parazamimus* (and all other rhinophorids) by several striking features, especially the almost total absence of leg setae (the only femoral setae, for example, being one fine submedian *pv* seta on each hind femur, and even this sometimes absent), the absence of *ia* setae, the presence of only a single pair of clearly differentiated scutellar setae (apicals absent), the reduction of abdominal vestiture to a few fine hairs, and the almost complete absence of fringes to the metathoracic spiracle (and also to the mesothoracic spiracle). The last-mentioned character is quite extraordinary for a calyptrate fly and I can recall no other genus in which the thoracic spiracles appear at low magnification to be such simple open holes (lacking protective fringes or opercula).

Bequaertiana males (but probably not the females, as yet unknown) have the abdomen and to a lesser extent the thorax thickly covered with brilliant silvery white pollinosity, a character of very rare occurrence in calyptrate flies. Presumably its functional significance is to flash in shafts of sunlight penetrating the forest environment (as in certain Stratiomyidae, for example, that have similar dense abdominal silver pollinosity).

Only five specimens of *Bequaertiana* are known belonging to two very closely allied and similar species (or ? subspecies), distinguishable by the following key.

Key to species of *Bequaertiana* Curran

1 Wing vein R_{4+5} with very fine widely spaced setulae on much of its length, the setulae more crowded on the node. Third antennal segment with a few long strong black hairs anteriorly (beyond the insertion of the arista). Ground colour of abdominal tergites (best seen beneath the pollinosity when seen from behind) mainly dark brown, but pale yellowish basally and narrowly creamy whitish on tergite hind margins. Mid and hind femora blackish brown (except for narrowly orange apices); mid coxae dark brown. Pleural regions of thorax pale tawny brownish darkening to shining dark brown or blackish brown on sternopleuron and mesopleuron . . . . **B. basilewskyi** Peris (p. 56)

– Wing vein R_{4+5} totally bare. Third antennal segment without long black hairs. Ground colour of abdominal tergites pale orange-yellow on about the basal two-thirds or more and brown on the remainder (almost no trace of cream-coloured hind margins to tergites except very narrowly and inconspicuously towards the sides). Mid and hind femora pale yellow on about basal three-fifths and pale brown on the remainder; all coxae yellowish. Pleural regions of thorax almost entirely pale reddish yellow (with only a trace of yellowish brown darkening medially on mesopleuron). . . . . **B. argyriventris** Curran (p. 55)

Bequaertiana argyriventris Curran

Bequaertiana argyriventris Curran, 1929 : 15; Townsend, 1935 : 251; Townsend, 1938 : 186; Zumpt, 1956 : 176; Peris, 1957 : 136. Holotype ♂, LIBERIA (AMNH, New York) [examined].

DESCRIPTION. ♂. Head ground colour black on interfrontal area, blackish brown on parafrontals and subparafacial areas, reddish on face, upper occiput blackish [parafacials rather yellow and posteroventral parts of head pale reddish in holotype but probably because natural colouring not fully developed]; antennae clear pale orange-yellow. Frons and vertex very broad, narrowest point of frons about 0·41 of head-width, vertex and upper occiput distinctly sunken. Interfrontal area well developed, subequal in width to parafrontal. Head setae rather fine. About 4–6 pairs of irregularly developed proclinate orbital setae. One pair of long outwardly and backwardly directed prevertical setae (accompanied by secondary prevertical hairs). Inner vertical setae subparallel. Frontal setae rather numerous and haphazardly disposed. Ocellar setae undifferentiated. Parafacial hairing black, rather strong, dense and uniform. Vibrissae weak, equal in size to largest pair of peristomal setae, facial ridges with some long black hairs immediately above vibrissae. Upper occiput with irregular black hairs behind postocular row. Lunula large and yellowish, bare, merging to face by a very slight flat carination that separates antennal bases. Antennae extremely small, in rather deeply excavate face, first and second segments apparently fused, second segment produced into a rather sharp prominent antero-apical flange, third segment exceedingly small and sub-orbicular (much smaller than second segment); arista hardly at all thickened at base and with non-elongate basal segments, with moderately long rather uniform plumosity along the whole length, the hairs springing out at all different angles. Mouthparts almost obsolete, in ventral view consisting of a cordate pad-like structure recessed in the oral cavity, a tuft of black hairs present inside the posterior oral margin. Thoracic ground colour almost uniformly pale reddish yellow, only darkened (to yellowish or slightly reddish brown) on sides of scutellum and on mid parts of mesopleura; dorsum of thorax (except scutellum) with uniform covering of thick brilliant silvery yellowish pollinosity (appearance varying with direction of light), pleural regions virtually non-pollinose. Humeral setae 1–2 [one on one side, two the other, in holotype]. Posthumeral setae absent. *Prst acr* setae absent [*post acr* setae uncertain, destroyed by pin in holotype]. Presutural seta strong. Both notopleural setae strong and subequal. 1 + 3 *dc* setae. Supra-alar area with only one seta (strong first *sa*). Intra-alar setae absent. Postalar callus hardly differentiated from scutum but with two very strong setae. Mesonotum almost devoid of normal surface hairing between *prst dc* seta and presutural seta and in whole large area between *post dc* setae and wing base, and bare also between the two median rows of acrostichal hairs and the *dc* position on the prescutum. Sides of thorax almost bare, vestiture consisting of a few hairs and about 2–4 setae (in the row) on the mesopleuron, a few hairs and two setae on sternopleuron, a minute prostigmatic seta and two or three hypopleural setae (propleural seta not even represented by a hair, pteropleuron all bare, infrasquamal hairs absent). Both thoracic spiracles with simple opening lacking marginal fringes or lappets. Legs yellow on coxae, trochanters, fore femora and basal three-fifths of mid and hind femora, darker yellowish brown on remainder; tarsi very slender, last segment very elongate, claws minute. Fore coxae elongate, with some very small sparse fine hairs on much of inner surface, hind coxae elongate. Femora and tibiae almost completely without evident setae: fore and mid femora totally without setae, hind femur with small submedian *pv* setae [one on one femur and two on the other in holotype]; fore tibia showing minute *pv* setula and hind tibia showing about two *ad* and a *pd* setula (but these scarcely larger than the hairing and only evident with high magnification). Wings faintly smoky brownish, membrane with large and conspicuous microtrichia, costa with long fine uniformly hair-like vestiture; venation as Fig. 28, *r–m* rather long (nearly half *m–cu*) [with median spur on each wing of holotype], *M* with almost no trace of angulation at junction of *m–cu*; tip of *Sc* obsolete, costal break almost obsolete; R_1 with long strong hairs closely set along its length; R_{4+5} (including its basal node) bare. Basicosta yellow; [halteres missing on holotype;] calyptrae translucent pale yellowish, lower calypter elongate, rather tapering and tongue-like. Abdominal ground colour dorsally pale orange-yellow on about the basal two-thirds of T1 + 2, T3 and T4, and on basal three-quarters of T5, and brown on remainder of the tergites, hind margins of tergites *very* narrowly and inconspicuously creamy towards the sides (ground colour only noticeable when fly viewed from behind and pale colour more evidently orange medially than at the sides). Entire upper surface of abdomen thickly covered with brilliant silver pollinosity (under surface without pollinosity and all yellow). Abdomen without any setae, vestiture consisting of *very* sparse and very fine recumbent hairs mainly on the apical halves of the tergites. T7 + 8, epandrium, cerci and surstyli yellow; T7 + 8 short and broad, well visible under T5, with two irregular transverse rows of black hairs; epandrium very short and broad; cerci apparently fused basally [genitalia not removed from holotype] but with very slender free parallel apices; surstyli *much* longer than cerci, rather large and prong-like and directed inwards. Sternites fully exposed in ventral abdominal membrane, St 5 with deep median incision

and prominent simple rounded lobes. Measurements: body length 6·2 mm, wing length 4·6 mm [1 specimen].

♀. Unknown.

MATERIAL EXAMINED. Holotype ♂, LIBERIA: Du River, camp 3 (*J. Bequaert*), in American Museum of Natural History, New York. (The holotype lacks the right fore and mid legs from the trochanters but is otherwise in good condition.)

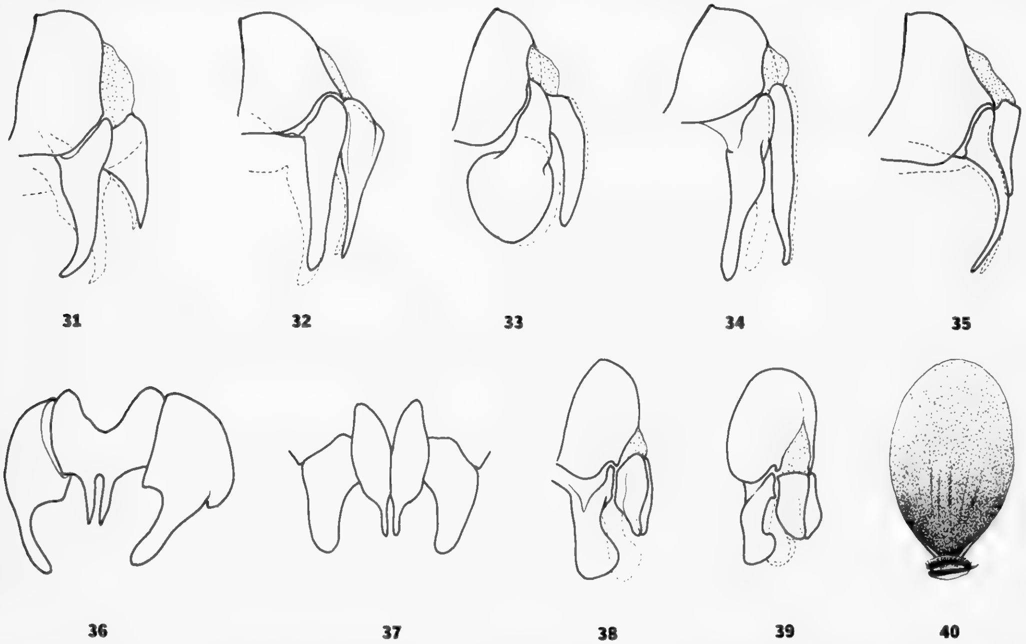
[While this paper was in proof it was seen by Dr Curtis Sabrosky, who kindly informed me of the existence of a second specimen of this very rare species that has not previously been recorded in the literature. Through the courtesy of Dr Sabrosky I have been able to see this specimen (from the U.S. National Museum, Washington, D.C.) and to compare it with the description of *argyriventris* holotype given above. It is a ♂ and undoubtedly conspecific with the holotype but very much smaller (body length 3·7 mm, wing length 3·0 mm), and with more extensively darkened abdominal tergites, one or two more hairs in the mesopleural row, minute ocellar hairs, and the subcostal vein virtually reaching the costa. Cross-vein *r-m* lacks the aberrant median stump that occurs in the holotype. The mid scutum (not visible in holotype because of the pin) shows 2–3 pairs of strong hairs in the mid line but no definite *post acr* setae.

Data of the specimen are: ♂, LIBERIA: 9.vii.1945 (*M. S. Briscoe*) (USNM). Specimen in good condition except for being slightly teneral and having lost left hind leg from the trochanter.]

Bequaertiana basilewskyi Peris

Bequaertiana basilewskyi Peris, 1957 : 136. Holotype ♂, RWANDA (MRAC, Tervuren) [examined].

DESCRIPTION. ♂. Closely similar to *argyriventris* described above, differing by the following features. Ocellar setae present (very fine and about as long as proclinate orbital setae). Third antennal segment with a few long black hairs on the anterior edge (distad of the aristal insertion). Sides of thorax extensively dark reddish brown to blackish brown on sternopleura and mesopleura and mainly tawny yellowish



Figs 31–40 (31–39) cerci and surstyli of ♂ genitalia in: (31) *Stevenia socotrensis*; (32) *Phyto tachinoides*; (33) *Melanomyoides capensis*; (34) *Rhinomorinia xanthocephala*; (35) *R. sarcophagina*; (36) *Bequaertiana basilewskyi*; (37) *Parazamimus congolensis*; (38) *Oplisa tergestina*; (39) *O. aterrima*. (40) ejaculatory sclerite in the genus *Oplisa* Rondani (drawn from *O. aterrima*). The cerci and surstyli in Figs 31–35, 38 & 39 are drawn slightly off-lateral, those in Fig. 36 slightly off-apical, and those in Fig. 37 are in exact apical view.

brown elsewhere, posterior part of mesonotum and scutellum darkened reddish brown. Postsutural *dc* setae variably developed and very fine, sometimes three but four or five haphazardly occurring in which the anterior ones rather hair-like and only the two posterior ones forming definite setae. Propleural seta represented by a small hair on the propleural angle. Mid coxa largely brown or dark reddish brown (conspicuously darker than fore and hind coxae). Mid and hind femora blackish brown (except for some orange colour at extreme apices). Wing vein R_{4+5} with long very fine and widely spaced setulae on about the proximal two-thirds, the setulae closer together towards the node; vein *M* slightly flexed backwards at junction of *m–cu*. Ground colour of abdomen dark brown dorsally on most of each tergite, tergites narrowly pale yellowish at the base and with conspicuous creamy white hind margins; tergite venters mainly yellowish brown or pale reddish brown, except for pale hind margins.

♀. Unknown.

MATERIAL EXAMINED. Holotype ♂, RWANDA: Ruhengeri, 1900 m, 27.i.1953 (*P. Basilewsky*), in Musée royal de l'Afrique centrale, Tervuren. (Holotype lacks left fore leg and right mid leg from the trochanters, but is otherwise in fair condition.)

UGANDA: 1 ♂, Kalinzu Forest (*T. H. E. Jackson*) (BMNH). ZAIRE: 1 ♂, Tshuapa, Bamania, 5.ix.1953 (*R. P. Hulstaert*) (MRAC: specimen in poor condition, having been at some time dried out from fluid, bearing Verbeke identification label as *B. argyriventris*).

Alphabetical check-list of the Afrotropical fauna

The check-list shows the classification of Afrotropical Rhinophoridae adopted in the foregoing text, but with the valid genera and species arranged alphabetically for convenience. Valid names are in bold type. Synonyms are chronological, in light-face type, and indented in relation to their valid names.

RHINOPHORIDAE Robineau-Desvoidy, 1830
- ***BEQUAERTIANA*** Curran, 1929
  - ***argyriventris*** Curran, 1929
  - ***basilewskyi*** Peris, 1957
- ***COMOROMYIA*** **gen. n.**
  - ***griseithorax*** **sp. n.**
- ***MELANOMYOIDES*** **gen. n.**
  - ***capensis*** (Zumpt, 1959) **comb. n.**
- ***MELANOPHORA*** Meigen, 1803
  - *Illigeria* Robineau-Desvoidy, 1830
  - ***roralis*** (Linnaeus, 1758)
    - *grossificationis* (Linnaeus, 1758)
    - *interventum* (Harris, 1780)
    - *interlapsa* (Walker, 1853)
- ***PARAZAMIMUS*** Verbeke, 1962
  - ***congolensis*** Verbeke, 1962
- ***PHYTO*** Robineau-Desvoidy, 1830
  - *Styloneuria* Brauer & Bergenstamm, 1891
  - *Britea* Curran, 1927 **syn. n.**
  - ***longirostris*** **sp. n.**
  - ***parafacialis*** **sp. n.**
  - ***paratachinoides*** **sp. n.**
  - ***stuckenbergi*** **sp. n.**
  - ***tachinoides*** (Curran, 1927) **comb. n.**
    - *maculosa* (Villeneuve, 1932)
- ***QUEXIMYIA*** **gen. n.**
  - ***flavipes*** **sp. n.**
- ***RHINOMORINIA*** Brauer & Bergenstamm, 1889
  - *Oxytachina* Brauer & Bergenstamm, 1891 **syn. n.**
  - *Pseudophania* Brauer & Bergenstamm, 1893 **syn. n.**
  - *Dewetia* Bischof, 1904 **syn. n.**
  - ***approximata*** **sp. n.**
  - ***atra*** (Bischof, 1904) **comb. n.**
  - ***bisetosa*** **sp. n.**
  - ***capensis*** (Brauer & Bergenstamm, 1893) **comb. n.**
  - ***scutellata*** **sp. n.**
  - ***setitibia*** **sp. n.**
  - ***verticalis*** **sp. n.**
  - ***vittata*** (Brauer & Bergenstamm, 1891) **comb. n.**
  - ***xanthocephala*** (Bezzi, 1908) **comb. n.**
    - *novicia* (Villeneuve, 1916) **syn. n.**
- ***STEVENIA*** Robineau-Desvoidy, 1830
  - *Eophyto* Townsend, 1919 **syn. n.**
  - ***socotrensis*** **sp. n.**
- ***VENTROPS*** **gen. n.**
  - ***milichioides*** **sp. n.**

Brief review of Oriental Rhinophoridae

On present evidence the rhinophorid fauna of the Oriental Region is extremely meagre, only four species (each in a different genus) being known from the area. The species have been listed earlier by me (Crosskey, in press) in the third volume of *A catalog of the Diptera of the Oriental Region* (Delfinado & Hardy, eds), and that catalogue and the present work provide the only

recent information on Oriental forms. The group has been so little collected that the four species are still known only from their type-material. A key for their identification is given below, followed by short notes on each of them.

1 Wing with cell R_5 long-petiolate and the bend of *M* forming an abrupt right-angle. Parafacials with proclinate setae 2
– Wing with cell R_5 open at the margin and the bend of *M* forming an evenly rounded and widely obtuse curve. Parafacials with some fine hairing but without setae 3
2 Antennal axis far above eye middle and antennae correspondingly very elongate. Parafacials with weak setae confined to the lower halves. Arista thickened on at least half its length and with second segment conspicuously elongate. Mid tibia with one *ad* seta. Intermediate abdominal tergites without median marginal setae. Fore tibia without *pd* setae. [♂ head with prevertical setae, outer vertical setae and one pair of proclinate orbital setae] ***Acompomintho lobata*** Villeneuve (p. 58)
– Antennal axis level with eye middle and antennae short. Parafacials with very strong setae on most of their height. Arista thickened only at the base and with second segment not elongate. Mid tibia with two *ad* setae. Intermediate abdominal tergites with median marginal setae. Fore tibia with two *pd* setae. [♂ unknown] . . . . ***Stevenia ceylanica*** (Townsend) (p. 59)
3 Legs and most of body pale reddish yellow. Palpi greatly enlarged, flattened and leaf-like, yellow with brownish tips and bearing strong spinous setae. Antennal axis far above eye middle (not much below topmost point of the eye). Wing veins R_1 and R_{4+5} finely setulose on their whole length. Mentum greatly enlarged and boat-shaped, yellow. Hind tibia with unusually large *d* preapical seta that is longer than the first hind tarsal segment and *much* larger than the *ad* and *pd* preapical setae. Mid tibia with two *ad* setae. Proclinate orbital setae absent. Vibrissae not more than half as long as epistomal width and not meeting or crossing ***Termitoloemus marshalli*** Baranov (p. 60)
– Legs and body black. Palpi normal, slender and black. Antennal axis about level with eye middle. Wing veins R_1 and R_{4+5} bare (except for the usual setulae on node). Mentum narrow and parallel-sided, dark brown. Hind tibia with normal *d* preapical seta that is much shorter than first hind tarsal segment and subequal in size to *ad* and *pd* preapical setae. Mid tibia with one *ad* seta. Proclinate orbital setae present (one pair). Vibrissae moderately strong, longer than epistomal width and cruciate . . . ***Rhinomorinia longifacies*** Herting (p. 59)

Acompomintho lobata Villeneuve

Acompomintho lobata Villeneuve, 1927 : 223. Syntypes ♂♀, FORMOSA (DEI & BMNH, probably elsewhere also) [BMNH syntypes examined].
Wagneriopsis formosensis Townsend, 1927 [July] : 281. Syntypes ♂♀, FORMOSA (DEI).

The nominal species *lobata* and *formosensis* are type-species respectively of *Acompomintho* Villeneuve (1927) and *Wagneriopsis* Townsend (1927). The descriptions were published a month apart (Villeneuve's on June 1st and Townsend's on July 1st), and Townsend (1931) established the synonymy of the specific names (thereby effectively establishing synonymy of *Wagneriopsis* and *Acompomintho*). In the 1931 work, and in later works, Townsend consistently mis-spelt Villeneuve's generic name as *Acampomintho*, an error perpetuated by Lopes (1938) and Hennig (1941). *Acompomintho* is the type-genus of Townsend's (1935 : 253) tribe Acompominthoini (proposed as Acampominthoini), a segregate not recognized in the present paper.

Acompomintho lobata is still known only from Formosa. It is easily recognized by the combination of long-petiolate cell R_5, long antennae and thickened arista (in which the second segment is unusually elongate like that of the Madeiran genus *Azaisia* Villeneuve). In addition to Villeneuve's detailed original description there is a German description by Herting (1961) and an extremely full and figured description in Portuguese by Lopes (1938).

The type-status of the original material of *lobata* and *formosensis* is muddled and both nominal species are here considered to be still based upon syntypes, the various citations of 'Holotype' and 'Typus' in the later literature being invalid for the reasons detailed below.

Villeneuve described *lobata* from 'nombreux individus' of both sexes from Tainan, Formosa, and gave the collecting date as 'II. 1909'. That he certainly had a large number of specimens before him at the time of description is clear from Hennig's (1941 : 186) recording '37 Typen' from

'Tainan II' as present in the Deutsches Entomologisches Institut (DEI) collection. Townsend (1931 : 383) referred to 'Male Ht' in 'Berlin-Dahlem' (i.e. holotype in DEI), and in a later work (Townsend, 1938 : 207) referred to 'Ht male – Origin, Tainan, Formosa; location, Berlin DEI' but in neither case does his statement 'Ht' (=holotype) constitute a valid lectotype fixation because there is no means of knowing which of the males from Tainan it was intended should be the primary type. Lopes (1938 : 556) referred to his seeing '4 exemplares typicos machos' without fixing a primary type.

In the case of *formosensis* the original material consisted of one male and six female specimens from Hokuto, Anping, Kankau and Macuyama (without indication of how many specimens of which sex from which locality). Townsend (1931 : 383) later referred to 'female Ht in Berlin-Dahlem, also from Formosa' but this statement does not pin the name *formosensis* to a single recognizable specimen. Townsend (1938 : 207) later referred to 'Ht female . . . from Hokuto . . . in Berlin DEI' and it is possible that this could be accepted as a valid lectotype fixation if only a single female from this locality exists. However, the situation is complicated by the fact that Lopes (1938 : 556) referred to 'exemplar holotypo (macho) de *W. formosensis* Towns., proveniente de Anping', and this statement might qualify for lectotype fixation if it could be shown conclusively that Townsend's (1938) statement did not fix the lectotype and that the Anping male specimen is the single original male syntype that Townsend described. (It is strange that Townsend should have cited a female as 'Ht' both in 1931 and 1938 when he had a male in his original 1927 series.) Hennig (1941 : 186) listed a specimen from Anping as 'Typus' but without even making it clear whether it was a specimen of *formosensis* or of *lobata*.

I conclude from the foregoing account that it is best to consider that no valid lectotype fixation exists either for *lobata* or for *formosensis* and that both nominal species are at present based on syntypes from which a lectotype can be validly designated in future.

MATERIAL EXAMINED. Syntypes of *lobata*: 1 ♂, 1 ♀ [head lost], FORMOSA: Tainan, ii.1909 (*H. Sauter*) (BMNH, by exchange with DEI in 1939).

Rhinomorinia longifacies Herting

Rhinomorinia longifacies Herting, 1966 : 451. Holotype ♂, NEPAL (BMNH) [examined].

This species is closely allied to the European species of *Rhinomorinia* and should probably be regarded as a Palaearctic element in the Oriental fauna. As only the holotype from Nepal is known nothing can be said further on this. Herting's original description is very detailed and needs no amplification.

MATERIAL EXAMINED. Holotype ♂, NEPAL: East Nepal, Taplejung District, between Sangu and Tamrang, 1700 m [5500 ft], 20.x.1961 (*R. L. Coe*) (BMNH). (The holotype was collected on mossy ground under bushes by a hill stream.)

Stevenia ceylanica (Townsend) **comb. n.**

Eophyto ceylanica Townsend, 1919 : 164. Holotype ♀, CEYLON (USNM) [examined].

This is the type-species of Townsend's (1919) monotypic genus *Eophyto*, which in the present work (see p. 48) is newly synonymized with *Stevenia*. Only the female holotype is known. Townsend's description of this is very brief and omits several characters important for comparison with other species. The following descriptive notes are therefore given to augment Townsend's description.

♀. Head with one pair of proclinate orbital setae, without outer vertical setae, with a pair of very small reclinate setae anterior to the prevertical setae. Ocellar setae undeveloped. Eyes rather rounded in profile, upper occiput slightly swollen. Vibrissal angles very weak, much less prominent than profrons. Epistome in the plane of the face. Parafacial setae consisting of a row of four or five setae fairly regularly spaced up whole parafacial height. Pollinosity of lower parts of parafrontals with a conspicuously shifting appearance seen from different angles. Antennae brownish basally and dark brown on apical two-thirds of third segments, pale orange on about basal third of third segments. Arista very fine and more or less bare. *Prst acr* setae almost undifferentiated, *pra* seta absent. Pteropleural seta very weak, two *stpl* setae. Fore

tibia with two *pd* setae, but without *pd* preapical seta. Mid tibia with two *ad* setae. Hind tibia with two *ad* setae, two small *av* setae, with *pv* apical seta. Wing with veins mainly yellow on proximal half and brown on distal half, membrane with brown infuscation near costal margin at apices of *Sc* and R_1 and before apex of R_{2+3}, and along the veins of the distal half (especially *m–cu* and M_1); basicosta pale yellow; calyptrae pale yellowish; halteres yellow. Petiole of cell R_5 extremely long, exceeding length of *m–cu*; *m–cu* right-angular in relation to *M*, closer to *r–m* than to bend, the bend *very* abrupt and right-angular; *m–cu* slightly outwardly oblique. Setulae of vein R_{4+5} confined to basal node; costal spine small and fine, about as long as *r–m*. Abdominal T1 + 2 with median marginal setae, T3 and T4 without discal setae; tergites 3–5 each with a narrow basal band of whitish pollinosity. Body length 4·5 mm, wing length 3·9 mm.

MATERIAL EXAMINED. Holotype ♀, CEYLON: Peradeniya, 3.vi.1914 (*A. Rutherford*) (USNM). (The data label on the holotype does not state the collector's name and this information is taken from Townsend's description.)

Termitoloemus marshalli Baranov

Termitoloemus marshalli Baranov, 1936 : 647. Holotype ♂, INDIA (BMNH) [examined].

This extraordinary calyptrate fly, still known only from the original holotype and two paratypes, may be incorrectly placed in the Rhinophoridae but appears to fit better there than in the Calliphoridae where it was originally described. The head is particularly unusual and has the oral fossa extremely large to accommodate a short but greatly enlarged and boat-shaped mentum of the proboscis, and the palpi are greatly expanded, flattened and rather leaf-like with exceptionally stiff spinous setae. The type-material was apparently collected whilst predatory on worker termites, and the strange palpi and gross proboscis are presumably adaptations for locating and consuming the prey. Because of the predaceous habit Baranov thought that the affinities of *T. marshalli* (the only species of *Termitoloemus* Baranov, *op. cit.*) might lie with *Bengalia* Robineau-Desvoidy, a calliphorid genus well known to be predaceous on ants: but apart from some, presumably convergent, resemblance between the proboscis of *Termitoloemus* and that of *Bengalia* there is no resemblance, and Sabrosky & Crosskey (1970) suggested that *T. marshalli* should be referred to the Rhinophoridae rather than the Calliphoridae. This placement is followed here, but it is emphasized that further knowledge of the biology might not support the assignment to Rhinophoridae (and, indeed, the predaceous habit is not one found elsewhere in the family to my knowledge).

Description of *T. marshalli* is not needed here as it can be easily identified from the key given above, Baranov's original description (in German) is extremely detailed, and Senior-White *et al.* (1940) have given a comprehensive English description. A few points may be noted, however, about the slide-mount of the holotype genitalia (in BMNH): the slide shows that the cerci are extremely reduced, the surstyli long and very narrow (but both broken and with missing apices), and the ejaculatory sclerite of an extraordinary umbrella-like or mushroom-like shape (different from that of other rhinophorids).

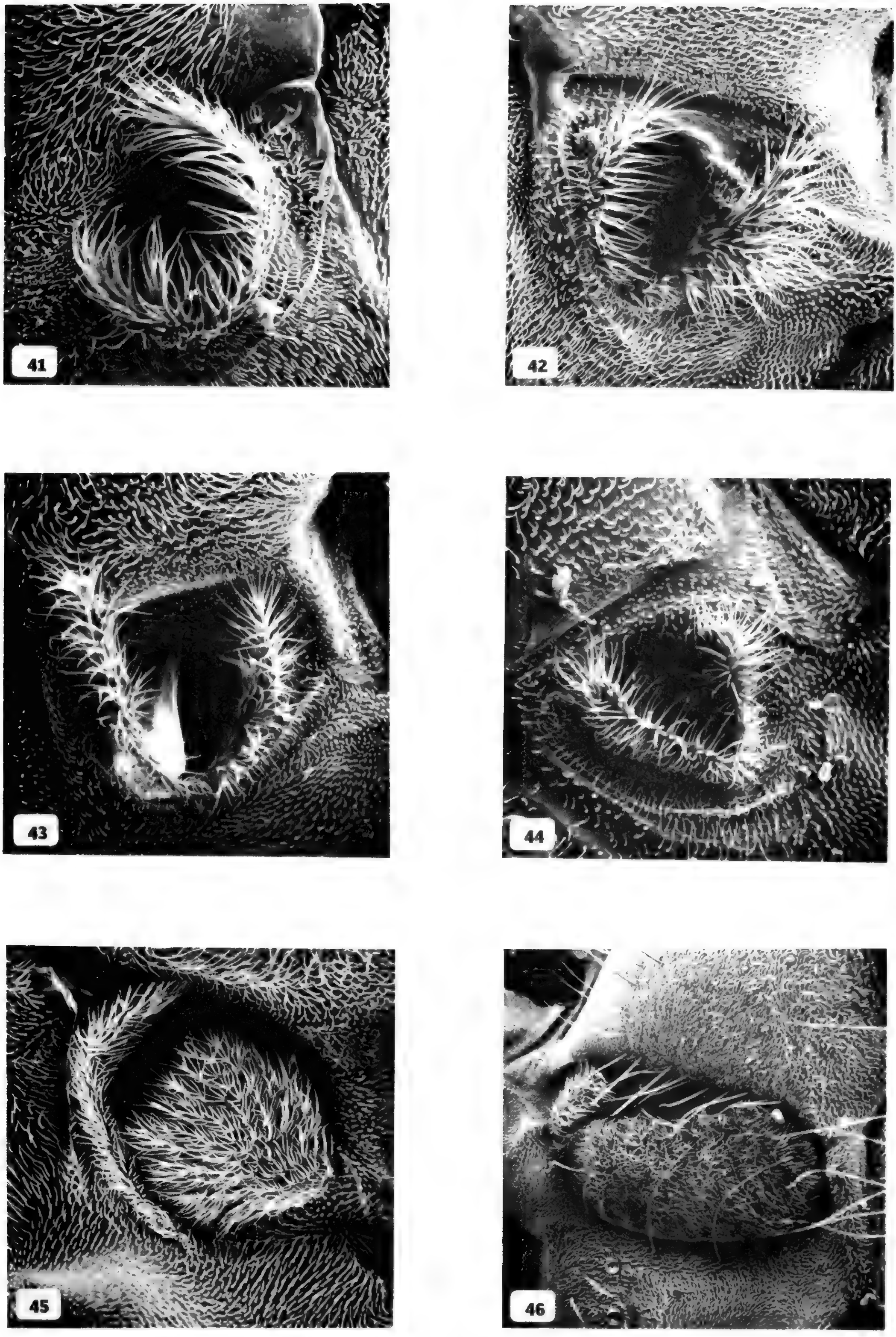
MATERIAL EXAMINED. Holotype ♂, INDIA: Uttar Pradesh, Kanpur [=Cawnpore], 3.ii.1935 (*H. N. Sharma*) (BMNH).

Paratypes. 2 ♀, data and depository as for holotype.

A note on the genus *Morinia* Robineau-Desvoidy in the Oriental Region

Since preparing the Rhinophoridae section for *A catalog of the Diptera of the Oriental Region* (Delfinado & Hardy, eds, in press) I have come upon two pieces of information suggesting that the genus *Morinia* occurs in the Oriental Region, in addition to the four genera mentioned above and in Crosskey (in press). Details are as follows.

(1) The BMNH collection contains a female paratype of *Idiopsis argenticincta* Senior-White, this being the specimen that Senior-White (1923 : 49) recorded in the original description as being in his own collection. This specimen (despite its very bad condition) can be seen immediately not to belong either in the genus *Idiopsis* Brauer & Bergenstamm in which it was originally described, or in the genus *Pollenia* Robineau-Desvoidy, in which Senior-White *et al.* (1940 : 125) subsequently placed it. In fact this paratype is not a calliphorid at all, but obviously



Figs 41–46 Stereoscan photographs of the left metathoracic spiracle of some Rhinophoridae compared with a tachinid and a calliphorid. (41) *Rhinophora lepida* (Meigen) (Rhinophoridae). (42) *Phyto discrepans* Pandellé (Rhinophoridae). (43) *Stevenia atramentaria* (Meigen) (Rhinophoridae). (44) *Melanophora roralis* (Linnaeus) (Rhinophoridae). (45) *Peribaea orbata* (Wiedemann) (Tachinidae). (46) *Phumosia lutescens* (Villeneuve) (Calliphoridae).

belongs in or close to the rhinophorid genus *Morinia* and is seemingly very near the European species *M. melanoptera* (Fallén) (though differing noticeably by possessing a broad fascia of silvery grey pollinosity on the posterior half of the prescutum). In all probability, therefore, *argenticincta* is a valid Indian species of *Morinia*. Definite assignment to, and combination of name with, *Morinia* cannot be made at present, however, because it is not possible to establish that the BMNH female paratype is conspecific with the male holotype of *argenticincta* from Simla, and there is a real possibility that Senior-White's original description confused two species. I have not attempted to locate the male holotype as it has not been sufficiently relevant for this paper, but even Senior-White was doubtful where it was deposited, remarking '*Type* in Imperial Agricultural Institute, Delhi?' (Senior-White *et al.*, 1940 : 125). If the holotype can be found it should be possible to confirm its suspected identity as that of a *Morinia* species. The data of the BMNH paratype are: ♀, INDIA: Uttar Pradesh, Kumaon, Muktesar, 2300 m [7500 ft], ix.1922 (*Fletcher*).

(2) Hennig (1941 : 186), in his catalogue of Formosan Diptera, listed a specimen from Chip Chip in the Deutsches Entomologisches Institut identified by Villeneuve as *Morinia melanoptera* (Fallén). The specimen has not been seen, but it seems unlikely that it was correctly identified. Herting (1961 : 9) does not mention Formosa under the distribution of *M. melanoptera*. On the other hand, it is possible that the Chip Chip specimen belongs to Senior-White's species '*Idiopsis*' *argenticincta*, which (as mentioned above) is most likely a *Morinia*.

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The ant tribe Tetramoriini (Hymenoptera : Formicidae)

The genus *Tetramorium* Mayr in the Oriental and Indo-Australian Regions, and in Australia

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Contents

Synopsis

The ant genus *Tetramorium* (=*Xiphomyrmex* Forel) is revised for the Oriental and Indo-Australian regions, and for Australia. Seventy-two species are recognized as valid in the Oriental/Indo-Australian regions and a further 17 endemic Australian forms are recognized (besides 6 species shared with other regions), so that the total number of species known from Australia is 23 and the *Tetramorium* fauna of all these regions together consists of 89 species. Of these 37 are described as new, 9 of them being from Australia. Twenty-nine new synonyms are established, the vast majority being of infraspecific forms.

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Two species are newly excluded from *Tetramorium: T. confucii* Forel is transferred to *Leptothorax* Mayr; and *T. guineense* (F.) is transferred to *Pheidole* Westwood.

A key is given to the Oriental and Indo-Australian species together, and a separate key to the Australian species.

Introduction

This paper represents part two of a projected series which, when completed, will cover the entire tribe Tetramoriini. The first part (Bolton, 1976) dealt with a review of the smaller genera, a revision of *Triglyphothrix* Forel, and an introduction to the genus *Tetramorium* with discussion of its genus-level synonyms. This part is thus the first dealing with *Tetramorium* proper and covers the faunas of the Oriental and Indo-Australian regions, and of the Australian continent. The genus also occurs in the Ethiopian and Malagasy regions and a few species are present in the Palaearctic; there is also a single endemic species in the New World.

For the sake of convenience Australia is treated separately from the other regions as its fauna consists to a large extent of endemic forms, with only a few species being shared with other regions. The Oriental and Indo-Australian are treated as a single region which also includes the whole of New Guinea and all the Pacific Island systems.

In all, the regions now under consideration have a total of 89 recognized species, 17 of which are found only in Australia. Most of the species have a fairly restricted distribution but some notable exceptions are present such as *bicarinatum*, *pacificum* and *simillimum* which occur throughout these regions, and others such as *kraepelini* and *smithi* have wide distributions within the regions.

Previous studies of the genus in these regions include Forel (1902b) and Bingham (1903) on the Indian–Sri Lankan fauna, and Mann (1919; 1921) on the Solomon Is and Fiji Is faunas respectively. Apart from these the fauna of the rest of the Oriental region, the Indo-Australian region and Australia have never been monographed previously.

Measurements and indices

Total Length (TL). The total outstretched length of the individual, from the mandibular apex to the gastral apex.

Head Length (HL). The length of the head proper, excluding the mandibles; measured in a straight line from the anterior clypeal margin to the mid-point of the occipital margin, in full-face view. (In species with a strongly concave occipital margin the head length is measured to the mid-point of a line connecting the posterolateral projections.)

Head Width (HW). The maximum width of the head behind the eyes, measured in full-face view.

Cephalic Index (CI). $\dfrac{\mathrm{HW} \times 100}{\mathrm{HL}}$.

Scape Length (SL). The straight-line length of the antennal scape excluding the basal constriction or neck.

Scape Index (SI). $\dfrac{\mathrm{SL} \times 100}{\mathrm{HW}}$.

Pronotal Width (PW). The maximum width of the pronotum in dorsal view.

Alitrunk Length (AL). The diagonal length of the alitrunk in lateral view from the point at which the pronotum meets the cervical shield to the base of the metapleural lobes or teeth.

All measurements are expressed in millimetres.

Abbreviations of museums

ANIC, Canberra	Australian National Insect Collection, Canberra City, Australia
BMNH	British Museum (Natural History), London, U.K.

CAS, San Francisco	California Academy of Sciences, San Francisco, California, U.S.A.
IE, Bologna	Istituto di Entomologia del'Università, Bologna, Italy
MCSN, Genoa	Museo Civico di Storia Naturale 'Giacomo Doria', Genoa, Italy
MCZ, Cambridge	Museum of Comparative Zoology, Cambridge, Mass., U.S.A.
MHN, Geneva	Muséum d'Histoire Naturelle, Geneva, Switzerland
MNHN, Paris	Muséum National d'Histoire Naturelle, Paris, France
MNHU, Berlin	Museum für Naturkunde an der Humboldt-Universität, Berlin, Germany (D.D.R.)
NM, Basle	Naturhistorisches Museum, Basle, Switzerland
NM, Vienna	Naturhistorisches Museum, Vienna, Austria
NR, Stockholm	Naturhistoriska Riksmuseet, Stockholm, Sweden
TM, Budapest	Természettudományi Muzeum, Budapest, Hungary
UM, Oxford	University Museum, Oxford, U.K.
USNM, Washington	United States National Museum, Washington, D.C., U.S.A.
UZM, Copenhagen	Universitetets Zoologiske Museum, Copenhagen, Denmark
ZSBS, Munich	Zoologisches Sammlung des Bayerischen Staates, Munich, Germany
ZMU, Helsinki	Zoological Museum of the University, Helsinki, Finland

Diagnosis of *Tetramorium*

TETRAMORIUM Mayr

Tetramorium Mayr, 1855 : 423. Type-species: *Formica caespitum* L., 1758 : 581, by subsequent designation of Girard, 1879 : 1016.

Xiphomyrmex Forel, 1887 : 385 [as subgenus of *Tetramorium*]. Type-species: *Tetramorium* (*Xiphomyrmex*) *kelleri* Forel, loc. cit.; by subsequent designation of Wheeler, 1911 : 175. [Synonymy by Bolton, 1976 : 359.]

Xiphomyrmex Forel; Emery, 1896 : 183; 1914a : 42. [Raised to genus.]

For a full statement of the generic synonymy of *Tetramorium* see Bolton (1976 : 359).

Diagnosis of worker and female. Myrmicine ants of the tribe Tetramoriini which have the following combination of characters. Mandibles with 2–3 enlarged apical teeth followed by a row of 4 (rarely more) denticles, so that at least 6 (usually 7) teeth are present altogether. Sting with an apical or apicodorsal translucent lamelliform appendage which may be spatulate, triangular, dentiform or pennant-shaped. Lateral portions of clypeus raised into a sharp ridge or shielding wall in front of the antennal insertions. Palp formula 4, 3 at maximum. (Usually with this count, very rare reductions to 4, 2; 3, 3 and 3, 2 are known.) Antennae with 11 or 12 segments, with an apical club of 3 segments. Body hairs never regularly branched bifid, trifid or quadrifid, usually simple but very rarely absent or bizarre. Head not roughly heart-shaped in full-face view.

Diagnosis of male. Myrmicine ants of the tribe Tetramoriini which have the following combination of characters. Mandibles dentate. Antennae with 10 or 11 segments, the second funicular an elongate fusion-segment; funiculus filiform. Palp formula 4, 3 at maximum, as worker/female. Body hairs as worker/female, never regularly branched.

A fuller definition of the genus has been given previously (Bolton, 1976), along with a discussion of the genus-level synonymy of *Tetramorium*. An abridged version of this synonymy is given above as in the regions at present under discussion only one other previously recognized generic name was applied, *Xiphomyrmex*. It has been shown that this name, based only on the reduced antennomere count of 11 in worker and female castes (as opposed to 12) has no significance as the 11-merous condition appears to have arisen several times from 12-merous ancestors in a number of widely divergent groups whilst other characters of generic significance have remained fixed. In consequence *Xiphomyrmex* was sunk as a junior synonym of *Tetramorium*.

The Oriental/Indo-Australian regions and Australia have two other tetramoriine genera represented besides *Tetramorium* itself. These are *Triglyphothrix* Forel and *Rhoptromyrmex* Mayr. The first of these has many endemic species in the Oriental/Indo-Australian but none in Australia. However, the widespread tramp species *Tr. lanuginosa* (Mayr) is present in all the regions. *Triglyphothrix* is differentiated from *Tetramorium* in all castes by the presence of regularly

branched hairs which are bifid, trifid or quadrifid and are usually conspicuous, although in a few species they are sparse or mixed with simple hairs.

Rhoptromyrmex has two species which occur in these regions. The workers may be distinguished from *Tetramorium* by their heart-shaped heads, broadly arcuate and prominent clypeal margins, 3, 2 palp formulae and complete absence of antennal scrobes. In the few *Tetramorium* species completely without scrobes the other characters noted do not apply. In the males the antennae are basically 9-segmented in *Rhoptromyrmex* and the three apical antennomeres form a club; the males also share the reduced palp formula count shown in the workers. Females (queens) of *Rhoptromyrmex* retain the basic tetramoriine traits but are strongly aberrant in other respects and are suspected of being temporary social parasites, although this has not yet been proved.

Species excluded from *Tetramorium*

Species originally described in *Tetramorium* (or its junior synonym *Xiphomyrmex* Forel) and removed prior to this study.

Tetramorium melleum Emery, 1897a : 586. Transferred to genus *Rhoptromyrmex* Mayr by Emery (1922 : 290) (see also Bolton, 1976).

Tetramorium scrobiferum Emery, 1897a : 587. Transferred to genus *Romblonella* Wheeler by M. R. Smith (1956 : 18) along with its described varieties (see also M. R. Smith, 1953).

Tetramorium opacum (F. Smith), 1861 : 47 [originally described in genus *Myrmica* Latreille]. Transferred to genus *Romblonella* Wheeler by Bolton (1976 : 294).

Tetramorium nitidum F. Smith, 1876 : 480. Transferred to genus *Chelaner* Emery by Ettershank (1966 : 96). [Synonym of *C. antarcticus* (White).]

Tetramorium striatum F. Smith, 1876 : 481. Transferred to genus *Huberia* Forel by Forel (1890 : CV).

Tetramorium coonoorense Forel, 1902a : 237. Transferred to genus *Triglyphothrix* Forel by Bolton (1976 : 346).

Tetramorium indosinense Wheeler, 1927a : 97. Transferred to genus *Triglyphothrix* Forel by Bolton (1976 : 348).

Xiphomyrmex flavigaster Clark, 1938 : 366. Transferred to genus *Chelaner* Emery by Bolton (1976 : 294).

Species newly excluded from *Tetramorium*.

Tetramorium confucii Forel, 1912 : 53. Syntype worker, TAIWAN (=Formosa): Pilam (*H. Sauter*) (MHN, Geneva) [examined]. This species is a quite ordinary member of the genus *Leptothorax* Mayr; its correct name is therefore *Leptothorax confucii* (Forel) **comb. n.**

Tetramorium guineense (F.), 1793 : 357 [originally described in genus *Formica* L.] Combination based on a misidentification as the types of *Formica guineensis* F. belong in genus *Pheidole* Westwood. Correct combination of the types is thus *Pheidole guineensis* (F.) **comb. n.,** and the first available name for the *Tetramorium* species involved in the misidentification is *T. bicarinatum* (Nylander) **stat. rev.** For discussion see p. 94.

Species of the Oriental and Indo-Australian regions

The 72 *Tetramorium* species of the Oriental and Indo-Australian regions are roughly divisible into 14 species-groups, of which 9 are restricted to these regions, the remainder having at least a few species occurring elsewhere.

Of the 14 groups some are relatively easily defined and compact, but a few are purely groups of convenience at present. The *bicarinatum*-, *mixtum*- and *tortuosum*-groups for instance have fairly good consistent characters which delimit them, but such as the *ornatum*-group are rather more vaguely defined as this is basically a group which has radiated widely in a comparatively restricted area (almost exclusively in New Guinea), and which has spread into niches occupied elsewhere by members of differing groups. Other groups which are mostly for convenience include the *scabrosum*- and *tonganum*-groups. In both of these the majority of species are small or minute and are not well enough known to allow their broader relationships to be deduced, though at least each group is based upon a core of certainly related species. The *ciliatum*-group is based

upon a core of related species surrounded by a number of peripheral and apparently not closely related forms which are linked mainly by their large size and coarse sculpture. Rather than create a lot of groups each containing one or two species I have placed all these forms together for the time being, until their derivations are better understood.

Three species occur in these regions which belong to groups based outside the regions, namely *nursei* of the *caespitum*-group (mostly Palaearctic), and *smithi* and *simillimum* of the *angulinode*- and *simillimum*-groups respectively, which are mostly of the Ethiopian region.

In the present study only species based in or restricted to the Oriental and Indo-Australian regions are dealt with. A few species in the northern Oriental region extend their range into the southern Palaearctic and these species are covered here. However, some species of the *caespitum*-group based on the Palaearctic may extend their ranges southward into the northern Oriental region. These are excluded from this survey and will be considered in a later part of the study.

Synonymic list of species

***tortuosum*-group**
- ***belgaense*** Forel
- ***eleates*** Forel **stat. n.**
- ***flavipes*** Emery
- ***noratum*** **sp. n.**
- ***pilosum*** Emery
- ***rinatum*** **sp. n.**
- ***shensiense*** **sp. n.**
- ***tortuosum*** Roger
  - *tortuosum* var. *bellii* Forel **syn. n.**
  - *tortuosum* var. *ethica* Forel **syn. n.**
- ***urbanii*** **sp. n.**
- ***vertigum*** **sp. n.**
- ***yerburyi*** Forel

***carinatum*-group**
- ***aspersum*** (F. Smith) **comb. n.**
  - *bismarckii* Forel **syn. n.**
  - *costatus* subsp. *willowsi* Wheeler **syn. n.**
- ***carinatum*** (F. Smith) **comb. n.**
  - *costatus* Emery **syn. n.**
  - *costatus* subsp. *flavescens* Emery **syn. n.**
  - *costatus* subsp. *deficiens* Emery **syn. n.**
  - *aruensis* Karavaiev **syn. n.**
- ***diligens*** (F. Smith) **comb. n.**
- ***gambogecum*** (Donisthorpe) **comb. n.**
  - *gambogecus* var. *flavus* Donisthorpe **syn. n.**

***tenuicrinis*-group**
- ***tenuicrinis*** (Emery) **comb. n.**

***angulinode*-group (mostly African species)**
- ***smithi*** Mayr
  - *smithi* var. *kanariense* Forel **syn. n.**
  - *simillimum* subsp. *laevinode* Forel **syn. n.**

***fergusoni*-group**
- ***fergusoni*** Forel

***caespitum*-group (mostly Palaearctic species)**
- ***nursei*** Bingham

***bicarinatum*-group**
- ***bicarinatum*** (Nylander) **stat. rev.**
  - *cariniceps* (Guérin-Méneville)
  - *kollari* (Mayr)
  - *modesta* (F. Smith)
  - *reticulata* (F. Smith)
- ***bicolor*** Viehmeyer
- ***cynicum*** **sp. n.**
- ***indicum*** Forel **stat. n.**
- ***insolens*** (F. Smith)
  - *guineense* var. *macrum* Emery **syn. n.**
  - *melanogyna* Mann **syn. n.**
  - *pacificum* var. *wilsoni* Mann **syn. n.**
  - *melanogyna* var. *pallidiventre* Wheeler **syn. n.**
- ***nipponense*** Wheeler **stat. n.**
- ***obtusidens*** Viehmeyer
- ***pacificum*** Mayr
  - *scabrum* Mayr **syn. n.**
  - *pacificum* var. *subscabrum* Emery **syn. n.**
- ***tricarinatum*** Viehmeyer **stat. n.**
  - *tricolor* Donisthorpe **syn. n.**
- ***validiusculum*** Emery
  - *longicarinum* Donisthorpe **syn. n.**

***ornatum*-group**
- ***basum*** **sp. n.**
- ***centum*** **sp. n.**
- ***etiolatum*** **sp. n.**
- ***navum*** **sp. n.**
- ***ornatum*** Emery
  - *ornatum* var. *obscurius* Forel **syn. n.**
- ***politum*** Emery
- ***rigidum*** **sp. n.**
- ***salomo*** Mann
- ***sculptatum*** **sp. n.**
- ***wagneri*** Viehmeyer

***inglebyi*-group**
- ***elisabethae*** Forel
- ***inglebyi*** Forel
- ***myops*** **sp. n.**

***mixtum*-group**
- ***amium*** Forel **stat. n.**
- ***mixtum*** Forel
- ***rugigaster*** **sp. n.**
- ***transversarium*** Roger

***scabrosum*-group**
- ***aptum*** **sp. n.**
- ***curtulum*** Emery
- ***kraepelini*** Forel
  - *eidmanni* Menozzi (nomen nudum)
  - *yanoi* Santschi **syn. n.**
- ***parvum*** **sp. n.**

pulchellum Emery
punctiventre Emery
scabrosum (F. Smith)
papuanum Emery **syn. n.**
tanakai **sp. n.**
tonganum-group
christiei Forel
cuneinode **sp. n.**
difficile **sp. n.**
infraspinum Forel
laparum **sp. n.**
salvatum Forel
seneb **sp. n.**
tonganum Mayr
magitae Forel **syn. n.**
vandalum **sp. n.**
ciliatum-group
chapmani **sp. n.**
ciliatum **sp. n.**
curvispinosum Mayr
flagellatum **sp. n.**
khnum **sp. n.**
tylinum **sp. n.**
zypidum **sp. n.**
simillimum-group (mostly African species)
simillimum (F. Smith)
caldarius (Roger)
parallelum (F. Smith) **syn. n.**
simillimum subsp. *denticulatum* Forel **syn. n.**
simillimum var. *opacior* Forel **syn. n.**
simillimum var. *insulare* Santschi **syn. n.**
antipodum Wheeler (provisional synonym)
auropunctata subsp. *brevispinosa* Borgmeier
Nomen dubium
infraspinosum Karavaiev

Key to species of the Oriental and Indo-Australian regions (workers)

Note. T. belgaense is known only from the female and is omitted from the key.

1 Antennae with 11 segments 2
– Antennae with 12 segments 17
2 Antennal scapes relatively very long, SI in range 109–148, visibly much longer than the head is broad. Petiole in profile a high, narrow node, the tergal portion much higher than long (Figs 3–5), node completely smooth, unsculptured 3
– Antennal scapes relatively shorter, SI in range 69–105 but usually <100. If SI in range 100–105 then petiole is not shaped as above and is sculptured, at least on the sides . 6
3 Metapleural lobes invisible or nearly invisible when alitrunk is viewed in profile; the lobes are low, rounded flanges, not projecting nor dentiform, not acute apically (Figs 4, 5) . 4
– Metapleural lobes distinctly visible when alitrunk is viewed in profile; the lobes acute and prominent, dentiform or triangular (Fig. 3). 5
4 Dorsum of head behind level of eyes unsculptured (Fig. 2). Antennal scapes with $SI<135$ (known range 128–129). Bicoloured species with head and gaster blackish brown, the alitrunk and all appendages bright yellow. (New Guinea) . . . . ***diligens*** (p. 87)
– Dorsum of head behind level of eyes strongly reticulate-rugose. Antennal scapes with $SI>135$ (known range 141–148). Colour uniform yellow-brown to mid-brown, not bicoloured as above. (New Guinea) . . . . ***gambogecum*** (p. 88)
5 Dorsum of head between frontal carinae with a few sharp, widely spaced longitudinal carinae, the spaces between which are unsculptured; cross-meshes between carinae only present behind level of eyes. Antennal scrobes unsculptured to level of posterior margins of eyes (Fig. 1). (Sulawesi, New Guinea, Aru Is) . . . . ***carinatum*** (p. 86)
– Entire dorsum of head between frontal carinae densely and coarsely rugose or reticulate-rugose, often with the spaces between rugae punctate or reticulate; cross-meshes numerous before level of posterior margins of eyes. Antennal scrobes sculptured or with a series of transverse rugulae before the level of the posterior margins of the eyes. (Philippines, Morotai I., Bismarck Archipelago, Solomon Is) . . . . ***aspersum*** (p. 86)
6 Propodeum unarmed, rounded or at most bluntly angulate but never with a differentiated pair of spines or teeth (Fig. 13). (New Caledonia, Fiji Is) . . . . ***tenuicrinis*** (p. 88)
– Propodeum armed with a conspicuous pair of spines or teeth 7
7 Mandibles smooth with scattered pits, not striate. Small species, SL 0·42–0·46. (Sri Lanka, India, Bhutan, Burma, Thailand, Vietnam, Malaya, Borneo, Sulawesi) . . . ***smithi*** (p. 90)
– Mandibles longitudinally striate; usually this sculpture coarse and distinct but if faint then species much larger, $SL>0{\cdot}65$ 8
8 Antennal scapes relatively short, SI in range 75–86 9
– Antennal scapes relatively long, SI in range 90–105 12
9 Entirety of head and alitrunk a bright orange or bright yellowish brown, the gaster the same colour as the head and alitrunk or lighter 10

– Entirety of head and alitrunk very dark reddish brown or blackish brown, the gaster darker than the head and alitrunk 11
10 Metapleural lobes low and rounded; petiole in dorsal view with the node much narrower in front than behind (Fig. 6). Larger species, HW > 0·90. (Sri Lanka) . . . . ***pilosum*** (p. 82)
– Metapleural lobes broadly triangular; petiole in dorsal view with the node about as broad in front as behind (Fig. 10). Smaller species, HW < 0·90. (China) . . . . ***shensiense*** (p. 83)
11 Dorsum of petiole with some reticulate-rugulose sculpture. Alitrunk reddish brown, the legs lighter, yellow-brown. (Malaya, Java, Sumatra, Sumba) . . . . ***eleates*** (p. 79)
– Dorsum of petiole with an unsculptured smooth median longitudinal strip. Alitrunk blackish brown, the legs clear pale yellow. (Thailand) . . . . ***flavipes*** (p. 81)
12 Propodeum armed with a pair of short triangular teeth which are only slightly longer than their basal width and only marginally longer than the metapleural lobes (Fig. 12). (Bhutan) ***urbanii*** (p. 84)
– Propodeum armed with a pair of long spines which are much longer than their basal width and considerably longer than the metapleural lobes (Figs 7–9, 11) 13
13 Dorsum of postpetiole with rugulose sculpture. (Sri Lanka) . . . . . ***yerburyi*** (p. 85)
– Dorsum of petiole unsculptured, smooth and shining 14
14 Petiole node in profile with the dorsum strongly arched-convex and usually completely unsculptured both on sides and dorsum; sides of petiole convergent dorsally so that the true dorsal surface is a narrow longitudinal strip; propodeal spines extremely long (Fig. 9). (Malaya, Borneo, Sulawesi) . . . . ***noratum*** (p. 81)
– Petiole node in profile with the dorsum not arched-convex, at least sides of petiole but often also the dorsum with sculpture; sides of petiole not or only slightly convergent dorsally and if the latter then sculpture on sides of node very pronounced; propodeal spines shorter (Figs 8, 11) 15
15 Entire body uniform yellow or light yellow-brown. Smaller species, HW in range 0·64–0·70. (Philippines) . . . . ***rinatum*** (p. 82)
– Entire body uniform dark brown or blackish brown. Larger species, HW in range 0·78–0·86 16
16 Dorsal surfaces of head and alitrunk with a very coarse, dense rugoreticulum, the edges of which are raised giving a reticulate–foveolate appearance in places. Posterior face of petiole convex in profile and overhanging the petiole–postpetiole junction (Fig. 8). Antennal scapes slightly longer, SI 97 at minimum. (Sulawesi) . . . . ***vertigum*** (p. 84)
– Dorsal surfaces of head and alitrunk with spaced-out low, rounded rugulae which in places form a weak reticulum and which have smooth interspaces, particularly on the promesonotum. Posterior face of petiole not convex in profile. Antennal scapes slightly shorter, SI 97 at maximum. (Sri Lanka, India) . . . . ***tortuosum*** (p. 83)
17 Lamelliform appendage of sting dentiform, triangular or pennant-shaped and projecting at an angle from the shaft 18
– Lamelliform appendage of sting linear and spatulate, continuing the line of the shaft. (India) . . . . ***fergusoni*** (p. 91)
18 Frontal carinae short, terminating at or in front of the level of the eyes (Figs 33, 36); dorsum of head never regularly and densely coarsely longitudinally rugose or sulcate . . . 19
– Frontal carinae long, projecting back beyond the level of the eyes (Figs 19, 44–46). If the carinae fade out just behind the level of the eyes (as opposed to approaching the occipital margin) then the dorsum of the head is regularly, very densely longitudinally rugose or evenly sulcate 23
19 Dorsum of head behind level of eyes unsculptured or at most with only very faint superficial sculpture, most of the dorsal head smooth and shining 20
– Dorsum of head behind level of the eyes sculptured 21
20 Antennal scapes relatively long, SI > 95; in full-face view the scapes distinctly and easily surpassing the occipital corners when laid back. Occipital margin evenly convex in full-face view. (New Guinea) . . . . ***politum*** (p. 107)
– Antennal scapes relatively short, SI < 90; in full-face view the scapes failing to reach the occipital corners by a considerable distance when laid back. Occipital margin feebly concave in full-face view. (India) . . . . ***nursei*** (p. 93)
21 Eyes minute, with only a single facet. Peduncle of petiole with a large, convex anteroventral lamella (Figs 36, 37). (India) . . . . ***myops*** (p. 111)
– Eyes larger, with five or more facets. Peduncle of petiole without a large convex anteroventral lamella 22

22 Petiole node in dorsal view about as long as broad. Median portion of clypeus abruptly down-curved so that its anterior one-third is vertical and separated by a marked angle from the more posterior portion. (India) . . . . ***inglebyi*** (p. 111)
– Petiole node in dorsal view much broader than long. Median portion of clypeus evenly convex in its anterior half. (India) . . . . ***elisabethae*** (p. 111)
23 Basal half or more of first gastral tergite sculptured, usually strongly so, with rugosity, dense striation, dense puncturation or a combination of these 24
– Basal half of first gastral tergite unsculptured or at most with sparse, short, regular basigastral costulae or a few pits from which hairs arise 27
24 Antennal scapes and hind tibiae with long projecting erect or suberect hairs 25
– Antennal scapes and hind tibiae without long projecting erect or suberect hairs . . . 26
25 Petiole node enormously developed, massive, in dorsal view almost as broad as the pronotum (Fig. 40). First gastral tergite feebly rugulose; HW *c.* 0·64. (Sri Lanka) ***transversarium*** (p. 115)
– Petiole node broader than long but nowhere near as broad as the pronotum in dorsal view. First gastral tergite strongly rugulose; HW 0·70 or more. (India) . . . ***rugigaster*** (p. 114)
26 Bright orange-brown to reddish brown. Node of petiole in dorsal view globular, about as broad as long. Dorsal surfaces of head and alitrunk covered with a dense rugoreticulum, the edges of which are sharply raised; without coarse, close-packed puncturation. (Philippines) . . . . ***chapmani*** (p. 120)
– Black. Node of petiole in dorsal view transversely ovate, broader than long. Dorsal surfaces of head and alitrunk rugulose, with numerous coarse, close-packed punctures. (New Guinea) . . . . ***punctiventre*** (p. 118)
27 Propodeum unarmed, the dorsum and declivity separated only by an obtuse angle (Fig. 55). (Java) . . . . ***infraspinum*** (p. 127)
– Propodeum armed with a pair of spines or teeth of variable size and shape 28
28 With the gaster in dorsal view the lateral corners of the base extended forward as a pair of horns which surround the posterior portion of the postpetiole (Fig. 38) 29
– With the gaster in dorsal view the lateral corners of the base rounded or sometimes bluntly angular, but never extended forward as a pair of horns which surround the posterior portion of the petiole 30
29 Eyes in front of middle of sides of head; scrobes not delimited by a margin posteriorly or laterally; node of petiole usually slightly longer than broad in dorsal view. (India) ***mixtum*** (p. 113)
– Eyes almost central on sides of head; scrobes delimited by a margin posteriorly and laterally, node of petiole not longer than broad in dorsal view. (Taiwan) . . . . ***amium*** (p. 113)
30 Anterior clypeal margin with the median portion convex and notched or sharply indented medially 31
– Anterior clypeal margin with the median portion entire, varying from convex to broadly and shallowly concave, but never notched or sharply indented medially 42
31 Mandibles sculptured with fine, dense striation or shagreening, occasionally the striation faint 32
– Mandibles completely smooth and shining except for scattered hair-pits 36
32 Median portion of clypeus with at least five major longitudinal carinae or rugae of about equal strength. Dorsum of head between frontal carinae at level of eyes with about 10 sharp longitudinal carinae of equal strength. Dorsum of postpetiole smooth or at most with faint superficial punctures or shagreening. (New Guinea) . . . . ***wagneri*** (p. 110)
– Median portion of clypeus with three major longitudinal carinae or rugae of about equal strength, sometimes with another much weaker pair also present which are often incomplete. Dorsum of head between frontal carinae at level of eyes without 10 sharp carinae of equal strength. Dorsum of postpetiole rugose or reticulate-rugose 33
33 Colour uniform dark brown to blackish brown. Petiole in profile shaped as in Fig. 15, with a narrow anterior peduncle, a short anterior face which curves into the long convex dorsum and a posterior face which is much higher than the anterior. In dorsal view the node is usually slightly longer than broad. (Throughout Oriental and Indo-Australian regions; widespread in Pacific islands; north Australia; sporadically introduced in N. America) ***pacificum*** (part) (p. 102)
– Colour yellow-brown to orange-brown, sometimes with the gaster darker brown. Rarely entirely coloured dark brown approaching that of *pacificum*, but in this case the petiole of different shape (Figs 16–18) 34
34 Longest hairs projecting dorsally from frontal carinae behind the level of the antennal insertions shorter than the maximum diameter of the eye (Fig. 21). Gaster always much

darker in colour than alitrunk and head, contrasting strongly with them. Petiole node in profile roughly square, the dorsum not sloping upwards posteriorly, the anterodorsal and posterodorsal angles approximately on a level (Fig. 16). (Throughout Oriental and Indo-Australian regions; widespread in Australia and Pacific islands; introduced in S. America, southern N. America, Madagascar, islands of Indian Ocean; common tramp in hothouses etc. in temperate zone) . . . . ***bicarinatum*** (p. 94)

– Longest hairs projecting dorsally from frontal carinae behind the level of the antennal insertions longer than the maximum diameter of the eye (as Fig. 22). Gaster usually same colour as alitrunk and head, only rarely noticeably darker. Petiole node in profile with the dorsum sloping upwards posteriorly so that the posterodorsal angle is on a slightly higher level than the anterodorsal (Fig. 18) 35

35 Propodeal spines long, either upcurved along their entire length or abruptly upcurved apically, or both (Fig. 18). Dorsum of head with reticular cross-meshes which are as strong as the longitudinal component of the sculpture occurring from the level of the anterior margins of the eyes to the occiput or sometimes from the posterior clypeal border to the occiput. Eyes generally slightly larger, their maximum diameter $0{\cdot}25$–$0{\cdot}28 \times$ HW. (Bhutan, southern strip of China, Vietnam, Japan, Okinawa, Taiwan) . . . . ***nipponense*** (p. 100)

– Propodeal spines usually short, elevated but more or less straight, not upcurved along their entire length, never abruptly upcurved apically. Dorsum of head with only longitudinal rugular sculpture to the level of the posterior margins of the eyes, behind which is a rugoreticulum. Eyes generally slightly smaller, their maximum diameter $0{\cdot}23$–$0{\cdot}25 \times$ HW. (Sri Lanka, India, Bhutan, Andaman Is, Burma, Java, Sumatra) . . . . ***indicum*** (p. 98)

36 Strongly bicoloured species with head and gaster blackish brown or black, the alitrunk and appendages yellow 37

– Uniformly coloured species, brown, black or yellow-brown; sometimes with gaster a different shade to remainder of body but never bicoloured as above 38

37 Dorsum of head with three strong, parallel longitudinal carinae running its length between the frontal carinae and with a few fainter short rugulae between these three principal carinae. Occipital margin with weak reticulate-rugulation or with anastomosis of the sculpture. (New Guinea, New Ireland) . . . . ***tricarinatum*** (p. 103)

– Dorsum of head with only the median carina developed and often this is broken or incomplete posteriorly. Remainder of dorsum of head with a few faint, weak rugulae but never with three strong carinae running the length of the head. Occipital margin without reticulation or anastomosis of the sculpture. (New Guinea) . . . . ***bicolor*** (p. 97)

38 Smaller species, HW $< 0{\cdot}65$, SL $< 0{\cdot}55$. (Thailand, Singapore, New Guinea) . ***obtusidens*** (p. 101)

– Larger species, HW $> 0{\cdot}65$, SL $> 0{\cdot}55$ 39

39 Dorsum of head sculptured with sparse but strong, regular longitudinal carinae or rugae, without any cross-meshes except sometimes for a few anastomoses very close to the occiput, but often absent even here (Fig. 19). Ground sculpture between carinae on head very inconspicuous or absent, the surfaces smooth 40

– Dorsum of head with rather irregular longitudinal rugae, with cross-meshes present varying from sparse to numerous; sometimes the whole head reticulate-rugose, but always with a conspicuous strong rugoreticulum posteriorly. Ground sculpture between rugae on head superficial but fairly conspicuous 41

40 Yellow-brown species with clypeal notch very strongly developed and anterior half of median portion of clypeus markedly transversely concave. Antennal scapes somewhat longer, SI in range 86–95. (Philippines) . . . . ***cynicum*** (p. 97)

– Blackish brown to black species with clypeal notch feeble and anterior half of median portion of clypeus not or only very feebly transversely concave. Antennal scapes somewhat shorter, SI in range 76–87. (New Guinea, north Queensland). . . . . . ***validiusculum*** (p. 103)

41 Clear yellow to light orange-brown species, usually with the gaster lighter in colour than the head and alitrunk, more rarely the same colour or slightly darker in shade. First gastral tergite without basal costulae. (Sri Lanka, Flores, Sulawesi, Philippines, Solomon Is, New Guinea, widespread in Pacific islands; introduced in hothouses in Britain and Germany) ***insolens*** (p. 99)

– Uniform dark brown or blackish brown. First gastral tergite usually with basal costulae present, often faint but hardly ever completely absent. (Throughout Oriental and Indo-Australian regions; widespread in Pacific islands; north Australia; sporadically introduced in N. America) . . . . ***pacificum*** (part) (p. 102)

42 Spaces between rugulose sculpture on entire dorsum of head (and often also dorsal alitrunk) completely filled by a dense and very conspicuous reticulate-puncturation so that the surface appears dull, matt and very granular, the punctate sculpture often as conspicuous as the rugulae 43

– Spaces between rugulose sculpture on dorsum of head either smooth or with superficial faint or vestigial sculpture so that the surface appears mostly or entirely shiny and largely or partially smooth, the punctate sculpture never as conspicuous as the rugulae . . . 46

43 Propodeum armed with a pair of short and usually stout teeth which are generally shorter than the metapleural lobes, only rarely slightly longer (Fig. 60). Dorsal alitrunk with sparse, short, thick, apically blunt hairs. (Pantropical tramp species of African origin; also introduced in hothouses in temperate zone). . . . . ***simillimum*** (p. 131)

– Propodeum armed with a pair of elongate, narrow spines which are distinctly much longer than the metapleural lobes (Figs 28, 30). Dorsal alitrunk with numerous elongate fine hairs which are generally acute apically 44

44 In profile the propodeal spines elevated and downcurved along their length (Figs 28, 30). Node of petiole in dorsal view as long as or longer than broad. Head and alitrunk dark reddish brown or blackish brown 45

– In profile the propodeal spines elevated and feebly upcurved along their length. Node of petiole in dorsal view broader than long. Head and alitrunk pale yellow-brown. (Philippines) ***laparum*** (p. 127)

45 Rugose sculpture of dorsum of head entirely longitudinal, without trace of cross-meshes. Basal one-third of first gastral tergite bright yellow, the remainder black or blackish brown. Propodeal spines very long, strongly downcurved (Fig. 30). (New Guinea) . . ***basum*** (p. 104)

– Rugose sculpture on dorsum of head mainly longitudinal but with numerous strong cross-meshes behind the level of the eyes. Gaster uniform blackish brown. Propodeal spines shorter than above and more feebly downcurved (Fig. 28). (New Guinea) . ***rigidum*** (p. 108)

46 Antennal scapes relatively long, SI 95–100. (New Guinea) . . . . . . ***etiolatum*** (p. 105)

– Antennal scapes relatively shorter, SI <93 47

47 Dorsum of head completely covered with very close-packed, regular coarse longitudinal rugae or sulci which run the length of the head, without any reticulation or cross-meshes . . 48

– Dorsum of head either reticulate-rugose or with disorganized, irregular, meandering or wavy spaced-out rugulation, or with numerous cross-meshes or with the rugulae short and broken 49

48 Antennal scrobes absent. With the head in full-face view the longitudinal sculpture strongly deflected posteriorly, often running down the sides of the head between the eye and the occipital corner. (New Guinea) . . . . ***sculptatum*** (p. 109)

– Antennal scrobes present but feeble. With the head in full-face view the longitudinal sculpture fanning out posteriorly and directed towards the occipital corners but not strongly deflected nor running down the sides of the head between the eye and occipital corner. (New Guinea, Bismarck Archipelago, Queensland) . . . . ***ornatum*** (p. 107)

49 Petiole in profile wedge-shaped, with the posterior and dorsal surfaces forming a single steep, shallow convexity (Fig. 56). (Thailand) . . . . ***cuneinode*** (p. 126)

– Petiole in profile nodiform, with the posterior and dorsal surfaces not forming a steep convexity, the two faces usually separated by an angle 50

50 Dorsal (outer) surface of hind tibiae with decumbent or appressed pubescence only or with very short hairs which are curved through 90° at the base so that the apical portions of the hair are nearly flush with the surface; erect or suberect hairs or erect pubescence completely absent from the outer tibial surface 51

– Dorsal (outer) surface of hind tibiae with conspicuous erect or suberect hairs or with erect pubescence, sometimes with both 56

51 Dorsum of postpetiole completely covered by a fine, dense, conspicuous rugoreticulum. (Solomon Is) . . . . ***salomo*** (p. 109)

– Dorsum of postpetiole completely smooth or at most with vestigial traces of punctulation . 52

52 Propodeal spines in profile over twice as long as the metapleural lobes and somewhat downcurved or sinuate along their length (Fig. 27). Primary sculpture of dorsal head consisting of 7–8 very strong, distinct, sharp carinae which run the length of the dorsum. Colour uniform blackish brown. (New Guinea) . . . . ***navum*** (p. 106)

– Propodeal spines varying from shorter than the metapleural lobes to slightly longer, but never twice as long, never downcurved or sinuate along their length (Figs 54, 58, 59). If

spines somewhat longer than metapleural lobes then primary sculpture of head is not of 7–8 strong carinae or the head and alitrunk are yellow to light yellowish brown, or both . 53

53 Antennal scapes relatively longer, SI 87–91. Colour uniform black. (India) . ***christiei*** (p. 124)

– Antennal scapes relatively shorter, SI 76–86, but if SI approaches 86 the entire body is yellow or yellowish brown 54

54 Peduncle of petiole in profile short, stout and straight, not downcurved along its length from node to insertion nor passing through an angle at about its midlength (Fig. 54). Metapleural lobes bluntly rounded. (India) . . . . ***salvatum*** (p. 128)

– Peduncle of petiole long, narrow and curved; either downcurved along its length from node to insertion or passing through a rounded angle at about its midlength so that the anterior portion slopes more strongly than the posterior portion (Fig. 59). Metapleural lobes triangular 55

55 Larger species, HW > 0·55, SL > 0·45, AL > 0·70, with slightly longer antennal scapes, SI 80–87. (Malaya, Java, Sumba, Philippines, Solomon Is, Sri Lanka, Japan, very widespread in Pacific islands; sporadically introduced in temperate zone hothouses etc.) . ***tonganum*** (p. 129)

– Smaller species, HW < 0·55, SL < 0·45, AL < 0·70, with slightly shorter antennal scapes, SI 75–77. (Nepal, Bhutan) . . . . ***difficile*** (p. 126)

56 Propodeal spines in dorsal view thick, long and strongly bowed along their length so that the apical halves tend to converge (Fig. 50). (Sri Lanka). . . . . . ***curvispinosum*** (p. 121)

– Propodeal spines in dorsal view not bowed along their length, usually distinctly divergent, sometimes short or very short 57

57 Node of petiole in dorsal view distinctly longer than broad, usually with an unsculptured median longitudinal strip; postpetiole unsculptured 58

– Node of petiole in dorsal view usually as broad as long or broader than long. If only fractionally longer than broad then either petiole dorsum is completely sculptured or postpetiole is sculptured, or both 59

58 Antennal scapes relatively longer, SI 81–86. Occipital margin of head broadly but very feebly concave in full-face view. (New Guinea) . . . . ***centum*** (p. 105)

– Antennal scapes relatively shorter, SI 69–75. Occipital margin of head strongly impressed medially in full-face view. (Philippines) . . . . ***zypidum*** (p. 123)

59 Larger species, HW 0·80 or more 60

– Smaller species, HW 0·75 or less 62

60 Erect hairs projecting from dorsal (outer) surface of hind tibiae varying in length but the longest of them at least as long as the maximum width of the tibia, usually longer. Postpetiole with coarse sculpture dorsally 61

– Erect hairs projecting from dorsal (outer) surface of hind tibiae uniformly short, the longest of them much shorter than the maximum width of the tibia. Postpetiole predominantly or entirely smooth and shining dorsally. (Borneo) . . . . ***tylinum*** (p. 123)

61 Hairs on dorsum of head and alitrunk exceptionally long, the longest being 0·45–0·50, well over half the length of the scape (Fig. 48). Leading edge of scapes without erect hairs that are longer than the maximum scape width. Postpetiole in profile relatively narrowly rounded (Fig. 48). (Borneo) . . . . ***flagellatum*** (p. 122)

– Hairs on dorsum of head and alitrunk long but not as above, the longest being *c.* 0·30, less than half the length of the scape (Fig. 49). Leading edge of scapes with a spaced row of long hairs that are longer than the maximum scape width. Postpetiole in profile relatively broadly rounded (Fig. 49). (Thailand, Vietnam) . . . . ***ciliatum*** (p. 121)

62 Anterior (leading) edge and dorsal surface of antennal scapes with pubescence only or with abundant short hairs of approximately uniform length, without a spaced row of distinctly longer, usually stouter erect hairs. Hairs on dorsal (outer) surface of hind tibiae uniformly short, fine and dense 63

– Anterior (leading) edge or dorsal surface of antennal scapes with a spaced row of long, erect hairs, all of which are conspicuously longer and usually stouter than any underlying pubescence which may be present. Dorsal (outer) surface of hind tibiae usually with at least a few elongate, quite stout hairs 64

63 Antennal scapes both relatively and absolutely longer, SL > 0·50, SI > 83. Propodeal spines narrow and short, at most only slightly longer than the metapleural lobes. Entirety of head and body black or blackish brown. (New Guinea) . . . . . ***vandalum*** (p. 131)

– Antennal scapes both relatively and absolutely shorter, SL < 0·45, SI < 76. Propodeal spines

well developed, much longer than the metapleural lobes. At least the alitrunk yellow or yellow-brown, never entirely black. (Malaya, Java) . . . . **seneb** (p. 128)

64 Dorsum of head between frontal carinae predominantly or entirely coarsely reticulate-rugose or reticulate-foveolate 65

– Dorsum of head between frontal carinae predominantly or entirely longitudinally rugulose, usually with some reticulation occipitally 67

65 Both petiole and postpetiole entirely covered with a coarse rugoreticulum, the two segments equally strongly sculptured and as strongly sculptured as the dorsal alitrunk. Larger species with shorter scapes, HW 0·66–0·74, SI 65–70. (Philippines) . . . **khnum** (p. 122)

– Petiole and postpetiole not covered with a rugoreticulum, the two segments very obviously less strongly sculptured than the dorsal alitrunk and usually with the petiole somewhat more strongly sculptured than the postpetiole. Smaller species with longer scapes, HW 0·56–0·62, SI 78–87 66

66 With alitrunk in dorsal view the anterior pronotal corners angular, giving a square-shouldered appearance (Fig. 41). (New Guinea, Aru Is) . . . . **scabrosum** (p. 119)

– With alitrunk in dorsal view the anterior pronotal corners broadly rounded, giving a round-shouldered appearance (Fig. 42). (New Guinea) . . . . **pulchellum** (p. 118)

67 Dorsal surfaces of both petiole and postpetiole completely covered by coarse sculpture. Eyes of moderate size, the maximum diameter 0·20–0·23 × HW. (Thailand, Malaya) . **aptum** (p. 115)

– Dorsal surfaces of either petiole, postpetiole or both unsculptured and shining. Very rarely both with some faint punctulation, in which case the eye size is outside the above range . 68

68 Eyes very small (Fig. 44). In HW range 0·58–0·70 the maximum diameter of the eye is 0·10–0·14, or about 0·16–0·19 × HW. (Malaya, Borneo) . . . . **curtulum** (p. 116)

– Eyes larger (Fig. 45). In HW range 0·52–0·64 the maximum diameter of the eye is 0·13–0·17, or about 0·25–0·30 × HW 69

69 With the petiole in profile the length of the dorsum of the node less than the height of the tergal portion of the node. Colour usually entirely yellow-brown, sometimes the gaster slightly darker, never bicoloured with alitrunk lighter than head and gaster, never uniformly black. (South China, Japan, Philippines, Java) . . . . **kraepelini** (p. 117)

– With the petiole in profile the length of the dorsum of the node equal to or greater than the height of the tergal portion of the node. Colour uniform black or with head and gaster much more darkly coloured than alitrunk 70

70 Head and body uniform black or blackish brown. (Java) . . . . **parvum** (p. 117)

– Bicoloured species with head and gaster blackish brown, the alitrunk, petiole, postpetiole and appendages yellow or pale yellowish brown. (Japan) . . . . **tanakai** (p. 119)

The *tortuosum*-group

Antennae with 11 segments, the sting appendage spatulate. Petiole nodiform and often sculptured, at least on the sides; in dorsal view commonly longer than broad. Propodeum armed with spines or teeth. Mandibles striate; dorsum of head generally with coarse rugose or rugulose sculpture but without strong ground-sculpture, the spaces between rugae being smooth or at most with only feeble traces of sculpture. Gaster always unsculptured. Antennal scapes usually with SI < 100, rarely slightly greater.

This group has 7 species in the Oriental region, 4 in the Indo-Australian, 5 in Australia and is also represented in Madagascar, but it is absent from the Ethiopian region. It is the main group of the genus with 11-segmented antennae in the Oriental and Indo-Australian regions and appears to be the group from which the Australian *striolatum*-group is descended.

Within the group the species *belgaense*, *eleates*, *flavipes*, *splendidior*, *strictum*, *turneri* and *confusum* form a complex of smaller, stoutly built species with the pronotum relatively broad. They are generally dark in colour (not *splendidior*) with short propodeal spines and with antennal scapes relatively shorter than in the remainder of the group, SI in range 75–85 in material examined. Of the seven names given above the first three are very closely related Oriental and Indo-Australian forms whilst the last four are Australian. In *splendidior* and *confusum* the petiole nodes are transverse and roughly rectangular in dorsal view (Fig. 63) but the nodes in *turneri* and *strictum* are shaped more like those seen in the Oriental and Indo-Australian species of the complex (compare Figs 64, 65 with 6, 9, 10).

The remainder of the group are generally larger but more slender species with longer propodeal

spines and relatively longer scapes, SI > 85, less than this only in *pilosum* and *shensiense*. Within this complex *yerburyi*, *pilosum*, *shensiense*, *urbanii* and *rinatum* are yellow-brown to bright orange-brown in colour and are distributed mainly in the Oriental region, only *rinatum* of the Philippines occurring outside it. The remaining species, *tortuosum*, *vertigum*, *andrynicum* and *noratum*, are brown or blackish brown. The first of these occurs in India and Sri Lanka, the second in Sulawesi and the third in Queensland. Only the last species has a wider distribution, being widespread in Malaysia and Indonesia but apparently not reaching New Guinea. In fact, the *tortuosum*-group is completely absent from New Guinea, but this may be explained by the presence of the specialized *carinatum*-group species and of convergent but not closely related species belonging to other groups (e.g. *politum* of the *ornatum*-group) which would appear to fill ecological niches occupied elsewhere by *tortuosum*-group members.

Tetramorium belgaense Forel

Tetramorium (*Xiphomyrmex*) *belgaense* Forel, 1902a : 238. Holotype female, INDIA: Belgaum (*Wroughton*) (MHN, Geneva) [examined].

FEMALE (holotype). TL 4·6, HL 0·86, HW 0·80, CI 93, SL 0·68, SI 85, PW 0·80, AL 1·36.

Mandibles striate. Antennal scrobes strongly developed, with an acute and marked dorsal margin; the frontal carinae continuing back almost to the occipital margin, well behind the lateral ocelli. Eyes large, maximum diameter *c*. 0·38. Alitrunk in dorsal view with the pronotal angles rounded, not prominent. Propodeum armed with a pair of long spines, the metapleural teeth about half as long as these spines, acute and upcurved. Node of petiole in profile roughly rectangular, higher than long, with the dorsum evenly but shallowly convex. Node of postpetiole feebly anteroposteriorly compressed, much higher than long, convex above. In dorsal view both nodes distinctly broader than long, maximum width of petiole and postpetiole respectively *c*. 0·36, 0·50. Dorsum of head coarsely longitudinally rugose with a few scattered cross-meshes. Pronotum reticulate-rugose, the remainder of the dorsal alitrunk sculptured as the head but the individual rugae lower and rounded, much less well defined. All surfaces of both pedicel segments coarsely reticulate-rugose, the gaster smooth and unsculptured. All dorsal surfaces of head and body with numerous stout hairs which are blunt apically. Colour reddish brown, the legs and antennae lighter, yellowish brown, the gaster darker red-brown.

Although first described as long ago as 1902 no other specimens which correspond to this species have ever been found. Its closest relative is certainly *eleates* but the known range of this species does not overlap that of *belgaense*. The queens of the two species are separated by the following characters:

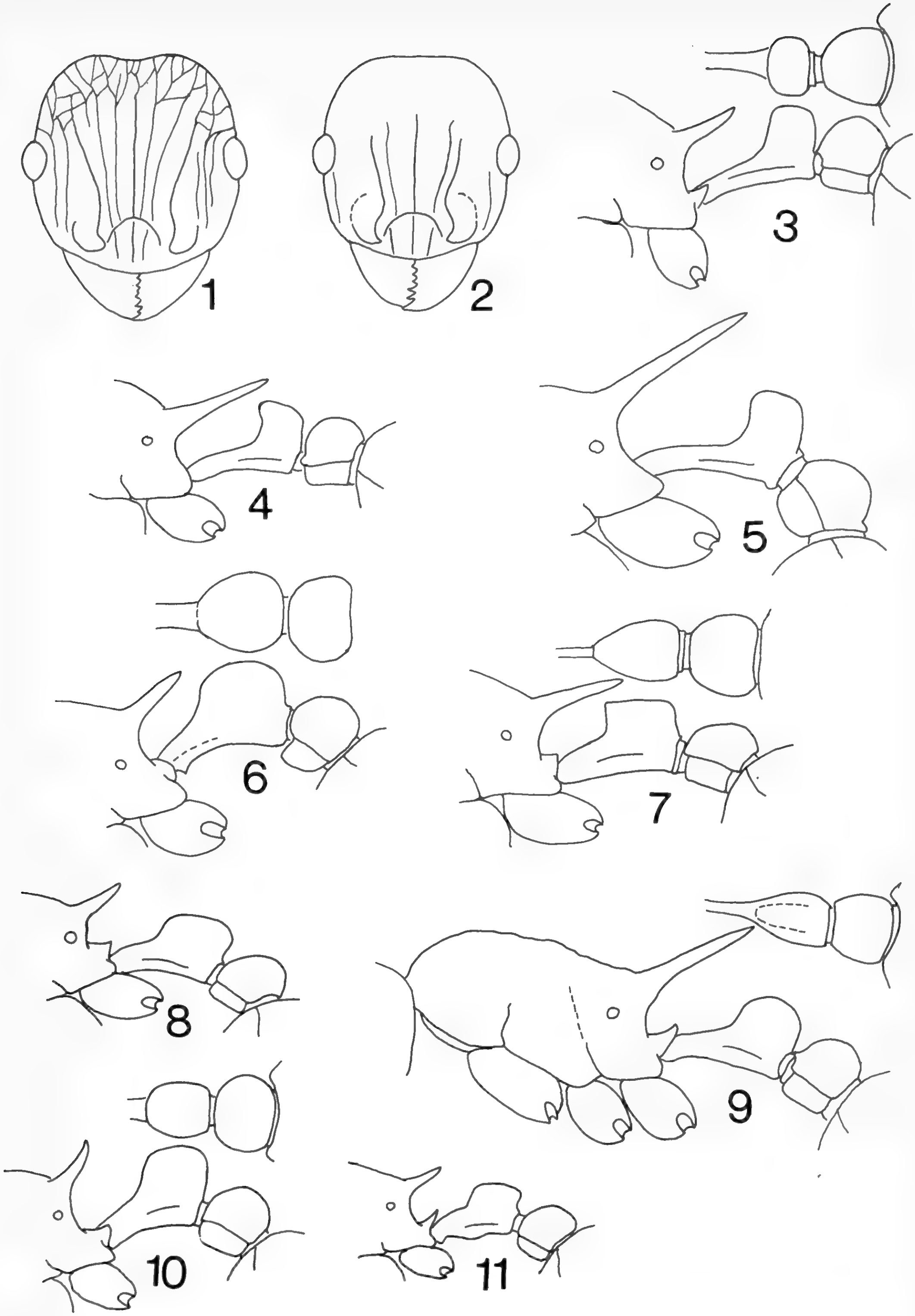
belgaense	*eleates*
Postpetiole reticulate-rugose	Postpetiole dorsum smooth
Tergite of postpetiole in profile much higher than long	Tergite of postpetiole in profile about as long as high
Eyes larger, maximum diameter *c*. 0·38	Eyes smaller, maximum diameter *c*. 0·22
Scapes relatively longer, SI 85 (with HW 0·80, HL 0·86)	Scapes relatively shorter, SI 76 (with HW 0·82, HL 0·86)

Tetramorium eleates Forel **stat. n.**
(Fig. 14)

Tetramorium (*Xiphomyrmex*) *tortuosum* var. *eleates* Forel, 1913 : 82. Syntype workers, females, SUMATRA: Bah Boelian (*Buttel-Reepen*) (MHN, Geneva) [examined].

WORKER. TL 2·7–3·8, HL 0·72–0·84, HW 0·68–0·78, CI 90–95, SL 0·54–0·62, SI 79–83, PW 0·56–0·66, AL 0·86–0·96 (10 measured).

Mandibles striate. Frontal carinae strongly developed, long, extending back almost to the occipital margin and forming the upper margin of a scrobe which will accommodate the scape. Alitrunk in dorsal view with strongly angulate pronotal corners. Propodeum armed with a pair of stout spines, the metapleural lobes dentiform and acute. Petiole node in profile roughly rectangular, slightly higher than long and shallowly convex dorsally, distinctly more massive than the postpetiole, the node of which is low and rounded. In dorsal view the petiole longer than broad, the postpetiole subglobular, only slightly broader than long. Dorsal surfaces of head and alitrunk reticulate-rugose, on the head the longitudinal



Figs 1–11. *Tetramorium* workers. 1, 2. Heads of (1) *carinatum*, (2) *diligens*, to show sculpture. 3–11. Propodeum and pedicel structure of (3) *carinatum*, (4) *diligens*, (5) *gambogecum*, (6) *pilosum*, (7) *yerburyi*, (8) *vertigum*, (9) *noratum*, (10) *shensiense*, (11) *rinatum*. Sculpture and pilosity omitted except in 1, 2.

component more pronounced than the cross-meshes. Sides and dorsum of petiole rugulose, the sides distinctly more heavily sculptured than the dorsum. Sides of postpetiole usually unsculptured, rarely with one or two fine, longitudinal rugulae, the dorsum always smooth and shining. Gaster unsculptured. Simple erect hairs numerous on all dorsal surfaces.

This medium-sized reddish brown species is apparently widely distributed in the Indo-Australian region, but does not appear to be common. It has been recovered from Malaya, Java, Sumatra and Sumba and shows remarkably little variation, for a tetramoriine, over that range.

The closest known related species are undoubtedly the Thailand *flavipes* and the Indian *belgaense*.

Further collections may show that the rather weak characters separating *eleates* and *flavipes* are not consistent (see key).

MATERIAL EXAMINED. WEST MALAYSIA: Malaya, Selangor, Batu caves (*Pagden*). SUMATRA: Sebesi I. (*Dammerman*). JAVA: Soekaboemi (no data). SUMBA: Mao Marroe (*Dammerman*).

Tetramorium flavipes Emery

Tetramorium (*Xiphomyrmex*) *flavipes* Emery, 1893 : 247, footnote 1. Holotype worker, THAILAND (*E. Simon* ?) (Probably in MCSN, Genoa).

WORKER. TL 3·2–3·6, HL 0·76–0·80, HW 0·70–0·76, CI 90–95, SL 0·53–0·62, SI 77–82, PW 0·58–0·62, AL 0·90–0·98 (12 measured).

Mandibles striate. Frontal carinae strong, reaching back almost to the occipital margin, where they merge with the sculpture. Occipital margin more or less straight to feebly concave in full-face view, the sides weakly convex. Antennal scapes moderate, SI as above. Alitrunk in dorsal view with sharply angled pronotal corners giving the alitrunk a 'square-shouldered' appearance. Propodeal spines elongate, narrow and acute; metapleural lobes elongate-triangular and sharp. Petiole node in profile slightly higher than long, with more or less parallel anterior and posterior faces and a convex dorsum. In dorsal view the petiole node is slightly longer than broad and a little broader behind than in front. Dorsal surfaces of head and alitrunk finely reticulate-rugulose, the sides and dorsum of the petiole rugulose but medio-dorsally there is a narrow unsculptured longitudinal strip. Postpetiole either completely smooth or at most with only very faint traces of sculpture laterally. All dorsal surfaces of head and body with erect hairs which are quite stout and tend to be blunted apically. Middle and hind tibiae without such hairs, with only short decumbent hairs. Colour black or blackish brown with pale yellow legs.

Very closely related to *eleates*, separated only tenuously by slight colour differences and the fact that in *eleates* the petiole dorsum tends to be sculptured over its entire surface whilst in *flavipes* there is an unsculptured median strip. These are very weak characters for separating two species of *Tetramorium* and I feel that further collections may show that these are but expressions of the same species.

MATERIAL EXAMINED. THAILAND: Nong Hoi (*D. Jackson*).

Tetramorium noratum sp. n.
(Fig. 9)

HOLOTYPE WORKER. TL 4·5, HL 1·04, HW 0·98, CI 94, SL 0·96, SI 98, PW 0·72, AL 1·22.

Mandibles striate, clypeus with a shallow median impression in the anterior margin. Sides of head evenly shallowly convex, the eyes prominent and quite small, maximum diameter *c.* 0·20. In full-face view the occipital margin broadly and quite deeply concave. Frontal carinae strongly developed and extending back almost to the occipital margin where they merge into the rest of the sculpture. Antennal scrobes poorly developed, represented by a groove below the frontal carinae which is mostly unsculptured but is considerably shorter than the scape. Pronotal corners angulate in dorsal view. Propodeal spines very long, the metapleural teeth triangular, acute and slightly upcurved. Dorsum of petiole longer than broad, the true dorsal surface a narrow strip as the sides of the petiole are convergent dorsally. In profile the dorsal surface of the petiole is strongly convex and meets the anterior face through a shallow curve so that the two are not separated by an angle. Postpetiole strongly convex dorsally. Head reticulate-rugose, more strongly so posteriorly as anteriorly the cross-meshes tend to be reduced or absent, leaving only the longitudinal component. Dorsal alitrunk reticulate-rugose but more loose and disorganized than on the head, the rugae forming sharp raised ridges. Petiole, postpetiole and gaster completely unsculptured,

smooth and highly polished. Dorsal surfaces of body with numerous erect or suberect hairs, those on the head and alitrunk longer than those on the gaster. The longest head and alitrunk hairs twice as long as the maximum diameter of the eye. Colour light brown, shining.

PARATYPES. As holotype, with a range of: TL 4·0–4·6, HL 0·98–1·06, HW 0·88–0·98, CI 90–95, SL 0·84–0·98, SI 95–100, PW 0·68–0·74, AL 1·14–1·22 (12 measured).

Holotype worker, WEST MALAYSIA: Malaya, Pahang, Fraser's Hill, *c.* 1220 m, hill forest, 15.viii.1967 (*R. Crozier*) (MCZ, Cambridge).

Paratypes. WEST MALAYSIA: 12 workers with same data as holotype. BORNEO: 1 worker, Pulau Laut *c.* 6 km E. Stagen dock, 3.vii.1972, rain forest (*W. L. Brown*) (MCZ, Cambridge; BMNH).

A third series of this species is known, collected in SE. Celebes (=Sulawesi), 1–2 km E. of Wolasi, 42 km S. Kendari, 12–14.vii.1972 (*W. L. Brown*). This consists of 28 workers, matching the above description but in most individuals with faint traces of rugulation on the sides of the petiole node.

Tetramorium pilosum Emery
(Fig. 6)

Tetramorium (*Xiphomyrmex*) *pilosum* Emery, 1893 : 247. Holotype worker, SRI LANKA: Kandy, 1892 (*E. Simon*) (MCSN, Genoa) [examined].

WORKER. TL 4·1–4·5, HL 0·94–0·98, HW 0·90–0·94, CI 94–96, SL 0·76–0·82, SI 81–86, PW 0·66–0·72, AL 1·20–1·30 (6 measured).

Antennae 11-segmented, the scrobe reduced to a short, shallow groove which runs a little beyond the posterior margin of the eye, although the frontal carinae themselves extend almost to the occipital margin. Petiole strongly nodiform in profile (Fig. 6) with the dorsal surface convex; in dorsal view the node is globular and almost as broad as long. Metapleural lobes rounded, not dentiform. Mandibles longitudinally finely striate-rugulose, dorsum of head longitudinally rugose with a rugoreticulum on the sides and close to the occipital margin. Dorsal alitrunk with an open, raised rugoreticulum which is repeated on the dorsum of the petiole node where the rugae are more closely packed. Postpetiole with fainter but still distinct longitudinal rugulae. Gaster smooth and shining. Dorsal surfaces of head, alitrunk, pedicel and gaster with abundant very long, fine, acute hairs, the longest of which are *c.* 0·30 in length.

This distinctive orange-brown species is very closely related to *yerburyi*, also of Sri Lanka, but the shape of the petiole is radically different in the two species, compare Figs 6 and 7. The other large species from Sri Lanka, *tortuosum*, has the node of the postpetiole quite unsculptured and the hairs on the dorsal surfaces of the head and body are much shorter, stout, and blunt apically.

MATERIAL EXAMINED. SRI LANKA: Kandy (*E. O. Wilson*).

Tetramorium rinatum **sp. n.**
(Fig. 11)

HOLOTYPE WORKER. TL 3·2, HL 0·76, HW 0·66, CI 87, SL 0·68, SI 103, PW 0·50, AL 0·90.

Mandibles striate. Frontal carinae well developed anteriorly but behind the level of the eyes becoming weaker until indistinguishable from the reticulate-rugulose sculpture on the posterior portion of the head. Antennal scapes relatively long, SI 100 or more. Propodeal spines of moderate length, narrow and acute, the metapleural lobes triangular, acute and somewhat upcurved. Petiole node in profile low and long, the ventral surface of the peduncle and node convex through most of its length (Fig. 11). In dorsal view the petiole node slightly longer than broad, narrowest in front and broadening posteriorly. Dorsal surfaces of head and alitrunk everywhere finely reticulate-rugulose, dorsal surfaces of petiole and postpetiole with only the faintest traces of sculpture, almost completely smooth. Sides of petiole with some rugulose sculpture. Gaster unsculptured. All dorsal surfaces of head and body with numerous elongate, fine hairs. Colour uniform yellowish brown.

PARATYPE WORKERS. TL 3·0–3·3, HL 0·76–0·80, HW 0·64–0·70, CI 84–87, SL 0·66–0·70, SI 100–103, PW 0·46–0·52, AL 0·86–0·92 (7 measured).

As holotype but some specimens slightly darker in colour.

Holotype worker, PHILIPPINES (PI on label): Dumaguete, 6.iv.27 (*J. W. Chapman*) (MCZ, Cambridge).

Paratypes. PHILIPPINES: 3 workers with same data as holotype; 4 workers, Dumaguete, Camp 4, 2.iv.31 (*J. W. Chapman*) (MCZ, Cambridge; BMNH).

A number of other specimens of this species are in the Chapman collection housed at MCZ, Cambridge, but are in poor condition. Also there is a single specimen from Taiwan (= Formosa) collected by L. Gressitt which may belong to this species or be a closely related new species. As only one specimen is available I am unable to say at the present time.

T. rinatum is a quite ordinary member of the *tortuosum*-group and the characters given in the key should separate it from its known allies without difficulty; it is the only member of its group known to occur in the Philippines.

Tetramorium shensiense sp. n.

(Fig. 10)

HOLOTYPE WORKER. TL 3·8, HL 0·88, HW 0·84, CI 95, SL 0·64, SI 76, PW 0·62, AL 1·04.

Mandibles striate; anterior clypeal margin with a shallow but quite distinct impression or notch medially. Clypeus with three strong carinae. Frontal carinae long and strong, extending back almost to the occiput and surmounted by a low, vertical, translucent lamella. Antennal scapes relatively short, SI < 80. Maximum diameter of eye *c.* 0·18. Occipital margin of head slightly indented medially, the sides of the head convex. Propodeal spines elongate, narrow, upcurved along their length. Metapleural lobes broadly and quite bluntly triangular. Petiole node in profile massive and high, the height of the tergal portion distinctly greater than the dorsal length. Anterior and posterior faces of node roughly parallel, the dorsum feebly convex. In dorsal view the petiole node about as broad in front as behind, broadest at the midlength. Dorsum of head with spaced-out relatively weak longitudinal rugulae and with sparse, very feeble cross-meshes so that the longitudinal component predominates. Occipital margin with some anastomosis of the rugulae forming a weak reticulum. Dorsal alitrunk with a weak disorganized rugo-reticulum which is strongest on the pronotum. Dorsum and sides of petiole with weak rugulae but the postpetiole almost completely smooth. Gaster unsculptured. All dorsal surfaces of head and body with numerous erect hairs. Colour orange-brown but the basal portion of the antennal scapes much darker, blackish brown or black.

PARATYPES. As holotype, with dimensions TL 3·7–3·8, HL 0·86–0·90, HW 0·82–0·86, CI 93–97, SL 0·64–0·66, SI 76–78, PW 0·62–0·64, AL 1·02–1·06 (3 measured).

Holotype worker, CHINA: Shensi Prov., Hu Hsien, 7.vi.1945 (*W. L. Brown*) (MCZ, Cambridge).

Paratypes. 3 workers with same data as holotype (MCZ, Cambridge; BMNH).

This species is close to *pilosum* of Sri Lanka and *urbanii* of Bhutan, but the former is larger than *shensiense* and has a differently constructed petiole node (compare Figs 6, 10), and the latter has much longer antennal scapes and shorter propodeal spines.

Tetramorium tortuosum Roger

Tetramorium tortuosum Roger, 1863a : 181. Syntype worker, female, SRI LANKA (*H. Nietner*) (location of types not known).

Tetramorium (*Xiphomyrmex*) *tortuosum* var. *bellii* Forel, 1902a : 239. Syntype workers, INDIA: Kanara (*Bell*) (MHN, Geneva) [examined]. **Syn. n.**

Tetramorium (*Xiphomyrmex*) *tortuosum* var. *ethica* Forel, *in* Escherich, 1911 : 225. Holotype worker, SRI LANKA (MHN, Geneva) [examined]. **Syn. n.**

WORKER. TL 3·8–4·4, HL 0·82–0·92, HW 0·78–0·86, CI 89–95, SL 0·70–0·80, SI 89–97, PW 0·60–0·70, AL 1·12–1·20 (15 measured).

Mandibles striate. Antennal scapes moderately long, with SI approaching 100 but apparently always with HW > SL. Frontal carinae long, reaching back almost or quite to the occipital margin, the latter broadly and very shallowly concave. Antennal scrobes shallow and feeble impressions, shorter than the scape and not capable of containing it. Pronotal corners in dorsal view with rounded angles. Propodeal spines strong and acute, the metapleural teeth acute and generally triangular, but narrow in some specimens. Node of petiole in profile longer than high, the dorsal surface feebly convex and meeting the anterior face in a blunt but distinct angle. Postpetiole rounded, convex above. In dorsal view the petiole node

slightly longer than broad, the postpetiole subglobular and somewhat broader than long. Dorsum of head firmly and predominantly longitudinally rugulose but with a tendency to form narrow and feeble cross-meshes, especially posteriorly. The rugulae themselves are narrow, low and rounded. Dorsal alitrunk with similar but even more feeble rugulation, in places the rugulae tending to be effaced and replaced by shining areas. Sides of petiole usually retaining faint traces of sculpture but the dorsum generally smooth, only rarely with vestiges of sculpture. Postpetiole and gaster unsculptured. Hairs on dorsal head and alitrunk variable in length, usually shorter and stouter in Sri Lankan populations than in examples from India.

This species is close to *yerburyi* and *pilosum*; its distinction from those species is discussed under *yerburyi*.

MATERIAL EXAMINED. INDIA: Kerala State, Wynaad Taluk, Kottiyoor (*A. B. Soans & W. L. Brown*); Cannonore Dist., Peria Res. (*Soans & Brown*); Wynaad Taluk, Thirunelly (*Soans & Brown*); Madras (*Soans & Brown*); Mysore (*D. Cavagnaro*); Kerala State, Silent Valley (*A. B. Soans & W. L. Brown*). SRI LANKA: Nuwara Eliya (*K. L. A. Perera*); Hakgala (*K. L. A. Perera*).

Tetramorium urbanii sp. n.
(Fig. 12)

HOLOTYPE WORKER. TL 4·0, HL 0·86, HW 0·80, CI 93, SL 0·74, SI 93, PW 0·62, AL 1·10.

Mandibles striate. Frontal carinae strongly developed, running back almost to the occipital margin, equipped above with a narrow, raised lamella which is distinct to the level of the eyes. Antennal scapes moderately long (SI range 90–95), much longer than the narrow scrobe which, however, is visible on the side of the head to just behind the posterior margins of the eyes. Maximum diameter of eye *c.* 0·20, about 0·25 × HW. In full-face view the occipital margin of the head more or less straight, only very feebly indented medially, sides of head feebly convex. Propodeum armed with a pair of short acute teeth which are only slightly longer than their basal width and only marginally longer than the narrowly rounded metapleural lobes. Petiole in profile as shown in Fig. 12; in dorsal view about as long as broad and much broader behind than in front. Dorsum of head with a few low meandering longitudinal rugulae and very few cross-meshes. Promesonotal dorsum mostly unsculptured, smooth and shining, with traces of rugulose sculpture towards the sides and also posteriorly. Petiole and postpetiole weakly rugulose but with a narrow unsculptured median strip on the dorsum of each segment. Gaster unsculptured. Erect hairs present on all dorsal surfaces of head and body. Colour orange-brown.

PARATYPES. TL 3·8–4·1, HL 0·78–0·88, HW 0·72–0·82, CI 91–95, SL 0·68–0·74, SI 90–95, PW 0·56–0·64, AL 1·00–1·12 (9 measured). As holotype but colour varying from orange-brown to light yellow-brown and with some individuals having the propodeal teeth broader than the holotype.

Holotype worker, BHUTAN: Phuntsholing, 2/400 m, 21–28.iv., Nat. Hist. Mus. Basel – Bhutan expedition 1972 (*C. Baroni Urbani*) (NM, Basle).

Paratypes. 9 workers with same data as holotype (NM, Basle; BMNH; MCZ, Cambridge).

Of the known species of the *tortuosum*-group *urbanii* has the shortest propodeal spines. This character, coupled with the moderately long scapes, should serve to separate *urbanii* from other species of the group.

Tetramorium vertigum sp. n.
(Fig. 8)

HOLOTYPE WORKER. TL 4·0, HL 0·96, HW 0·90, CI 94, SL 0·90, SI 100, PW 0·70, AL 1·20.

Mandibles longitudinally striate. Sides of head slightly convex, the occipital margin broadly but shallowly concave. Frontal carinae extended behind the level of the eyes but posteriorly petering out and becoming confused with the sculpture on the vertex. Scrobes narrow and poorly defined, not capable of accommodating the scapes, which are long, SI about 100. Propodeum with a pair of acute spines, the metapleural lobes triangular. Node of petiole in profile longer than high, shaped as in Fig. 8, the post-petiole lower and broadly rounded. In dorsal view the petiole node roughly oval, longer than broad, somewhat broader behind than in front and slightly flattened posteriorly. Postpetiole in dorsal view subglobular, slightly broader than long. Dorsum of head behind level of eyes and entire dorsal alitrunk very coarsely reticulate-rugose, the reticulations raised and very conspicuous. Anterior portion of cephalic dorsum with the longitudinal component predominating. Sides of petiole with coarse rugae which are

mostly directed diagonally, the dorsum with a median unsculptured longitudinal strip. Postpetiole and gaster unsculptured, smooth. All dorsal surfaces of head and body with numerous long, erect fine hairs which are acute apically. These hairs densest on the head and alitrunk, the longest being distinctly longer than the maximum diameter of the eye. Colour a very dark brown, almost black.

PARATYPE WORKERS. As holotype but in some the mandibular striation less distinct and the rugae on the sides of the petiole irregular. Size range: TL 3·6–4·2, HL 0·90–1·02, HW 0·80–0·92, CI 89–94, SL 0·84–0·90, SI 97–105, PW 0·60–0·70, AL 1·12–1·22. In general the smaller workers have relatively longer scapes than the larger workers.

Holotype worker, SULAWESI (S. Celebes on data label): S., Balampesoang Forest, 5–8 km NE. Tanete, 400 m, 8–10.vii.1972, rot. wood; degrad. rain for. (*W. L. Brown*) (MCZ, Cambridge).

Paratypes. 14 workers with same data as holotype (MCZ, Cambridge; BMNH).

In the MCZ, Cambridge collection is a single worker collected by W. L. Brown in N. Sulawesi at Mt Tangkoko-Batuangus Res. In this specimen the mandibles are predominantly smooth and the metapleural lobes are low and triangular.

Tetramorium yerburyi Forel
(Fig. 7)

Tetramorium (*Xiphomyrmex*) *pilosum* st. *yerburyi* Forel, 1902a : 238. Syntype workers, SRI LANKA (*Yerbury*) (MHN, Geneva) [examined].

Tetramorium yerburyi Forel; Bingham, 1903 : 187. [Raised to species.]

WORKER. TL 4·2–5·0, HL 1·02–1·10, HW 0·94–1·04, CI 90–95, SL 0·94–1·02, SI 98–102, PW 0·70–0·74, AL 1·24–1·36 (11 measured).

Mandibles striate. Frontal carinae extended back almost to the occipital margin, becoming confused with the sculpture close to the margin, the latter broadly and distinctly concave. Scapes of moderate length, SI in range given above. Antennal scrobes feebly developed, merely a short, shallow impression below the anterior half of the frontal carina. Pronotal corners rounded in dorsal view. Propodeal spines long and acute, metapleural lobes very obtusely triangular, variable in shape. Petiole shape in profile characteristic of the species, the anterior face straight and vertical, the dorsal surface flat or at most very feebly convex, the two meeting in a sharply defined right-angle (Fig. 7). The node itself is longer than high and the postpetiole is broadly rounded above in profile. In dorsal view petiole node narrowed in front. Head longitudinally rugose, finely reticulated posteriorly. Dorsal alitrunk with a rugoreticulum which is coarser than that on the head though less clearly defined. Dorsal surfaces and sides of petiole and postpetiole rugose, usually reticulate on the sides; the postpetiolar dorsum with weaker sculpture than the petiole, often longitudinal. Dorsal surfaces of head and body with numerous hairs, some of which are extremely long and fine. Colour orange-brown.

Of the three species of this group occurring in Sri Lanka two (*pilosum* and *yerburyi*) are endemic, and a third, *tortuosum*, is also found in south India. (The fourth Sri Lankan species, *smithi*, is widespread in the Oriental region but does not belong to this group.) *T. pilosum* and *yerburyi* are closely related and share the character of having the postpetiole sculptured. In *tortuosum* this sclerite is smooth. The two endemic Sri Lankan species are quickly separable by the shape of the pedicel, and a comparison of Figs 6 and 7 conveys these differences better than a verbal description.

MATERIAL EXAMINED. SRI LANKA: (*Yerbury*); Kandy (*E. O. Wilson*).

The *carinatum*-group

Antennae with 11 segments, the sting appendage spatulate. Large, rather slender, elongate species with long legs and relatively long or very long antennal scapes, SI in the range 109–148. Propodeal spines long, the metapleural lobes very reduced in *diligens* and *gambogecum* but moderately developed in *aspersum* and *carinatum*. Peduncle of petiole very long, the petiole node high and narrow (Figs 3–5). Petiole, postpetiole and gaster unsculptured but sculpture of head and alitrunk variable in density and intensity. Mandibles striate but sometimes only feebly so.

A small group of only four species centred upon New Guinea where three of the four are present. One species, *aspersum*, does not occur on New Guinea itself but is widely distributed in

the Philippines, Bismarck Archipelago and Solomon Islands. Of the other species, *diligens* and *gambogecum* are only known from New Guinea or its offshore islands but *carinatum* is also recorded from the Aru Islands and Sulawesi.

In general appearance the members of this group show convergence upon the *aculeatum*-group of Africa which show many modifications similar to those of the *carinatum*-group but which retain 12-merous antennae and a dentiform sting appendage. On New Guinea members of the *carinatum*-group replace in part the members of the *tortuosum*-group, which are absent from the island.

Tetramorium aspersum (F. Smith) **comb. n.**

Myrmica aspersa F. Smith, 1865 : 72. Syntype workers, INDONESIA: Morty (= Morotai) Is (*A. R. Wallace*) (UM, Oxford; BMNH) [examined].

Tetramorium (*Xiphomyrmex*) *bismarckii* Forel, 1901 : 11. Holotype worker, BISMARCK ARCHIPELAGO: 'bei Ralum in Lowon. Im Wald bei Kabakaul' (*F. Dahl*) (MHN, Geneva) [examined]. **Syn. n.**

Xiphomyrmex aspersa (F. Smith) Donisthorpe, 1932 : 473.

Xiphomyrmex costatus subsp. *willowsi* Wheeler, 1934b : 177. Syntype workers, SOLOMON Is: Malaita I., Uras Cove, 28.v.1933, and San Cristoval I., Star Harbour, 1.vii.1933 (*M. Willows*) (MCZ, Cambridge; CAS, San Francisco) [examined]. **Syn. n.**

WORKER. TL 3·6–4·4, HL 0·86–1·00, HW 0·76–0·90, CI 82–93, SL 0·86–1·10, SI 109–126, PW 0·60–0·74, AL 1·06–1·20 (31 measured).

Mandibles feebly and superficially longitudinally striate. Antennal scapes very long. SI always > 105, projecting well beyond the occipital margin when laid back in full-face view. Scrobes reduced to a narrow impression bounded above by the extensions of the frontal carinae, petering out posteriorly, and with a series of transverse rugae running across the impression. Metapleural lobes long and dentiform, acute. Petiole in profile a high, narrow node, the tergal portion much higher than long. Postpetiole generally more massive than petiole. Dorsum and sides of head covered with a loose, open rugoreticulum except anteriorly between the frontal carinae where the cross-meshes are feeble or absent and the sculpture is predominantly or completely of longitudinal rugae. Density and intensity of cephalic sculpture vary amongst different populations but are always distinctive. Dorsal alitrunk with a rugoreticulum but the pedicel segments and gaster unsculptured, completely smooth. All dorsal surfaces of body and head with erect or suberect hairs. Colour uniform yellow-brown to reddish brown.

This is a widespread and very variable species. Of the material which I have examined no two populations are exactly alike but all show variation in eye diameter, intensity and density of sculpture, size and degree of hairiness. Considerable variation may be met in nest-series as one sample from Dumaguete (Philippines) collected by J. W. Chapman on 4.ix.1927 shows a CI range of 87–93 and an SI range of 109–123, which virtually spans the known range for the species as a whole.

There is an obvious temptation to separate the more extreme forms of this species and treat them as separate entities but I am by no means convinced (with the rather limited number of samples available) that any lines other than arbitrary ones can be drawn to subdivide this mass at present. Of course, when more collections have been made one or more siblings may possibly be separated, but I feel that this will not be accomplished for some time yet.

MATERIAL EXAMINED. PHILIPPINES: Los Banos (*Baker*); Los Banos (*F. X. Williams*); Dumaguete (several series) (*J. W. Chapman*); Mindanao, Mt McKinley (*F. G. Werner*). SOLOMON IS: San Jorge (R. ent. Soc. exped.); West Bay (*W. M. Mann*); Fulakora (*W. M. Mann*); Bio (?) (*W. M. Mann*).

Tetramorium carinatum (F. Smith) **comb. n.**
(Figs 1, 3)

Myrmica carinata F. Smith, 1859 : 148. LECTOTYPE worker, INDONESIA: Aru Is (*A. R. Wallace*) (UM, Oxford), here designated [examined].

Tetramorium (*Xiphomyrmex*) *costatus* Emery, 1897a : 587, pl. 15, fig. 26. Syntype workers, NEW GUINEA (*L. Biró*) (MCSN, Genoa) [examined]. **Syn. n.**

Tetramorium (*Xiphomyrmex*) *costatus* subsp. *flavescens* Emery, 1897a : 588. Holotype worker, NEW GUINEA: Berlinhafen (*L. Biró*) (MCSN, Genoa) [examined]. **Syn. n.**

Tetramorium (*Xiphomyrmex*) *costatus* subsp. *deficiens* Emery, 1897a : 588. Holotype worker, NEW GUINEA: Berlinhafen (?) (*L. Biró*) (location of type not known). **Syn. n.**

Xiphomyrmex carinata (F. Smith) Donisthorpe, 1932 : 455.

Xiphomyrmex aruensis Karavaiev, 1935 : 105, fig. 24. Syntype workers, INDONESIA: Aru Is, Wammer, 9.iii.1913, no. 2567 (*V. Karavaiev*) (location of types not known). **Syn. n.**

WORKER. TL 3·9–4·6, HL 0·92–1·00, HW 0·82–0·90, CI 86–93, SL 0·94–1·04, SI 109–119, PW 0·64–0·74, AL 1·16–1·24 (20 measured).

Mandibles usually very feebly striate, more rarely smooth. Antennal scapes elongate, projecting beyond the occipital border when laid back in full-face view and with SI > 105. Antennal scrobes reduced to an impression bounded above by the frontal carinae and below by a strong longitudinal ruga but appearing quite distinctive as they lack any sculpture to the level of the posterior margin of the eye. Propodeal spines quite short (Fig. 3), generally feebly upcurved along their length. Metapleural lobes dentiform, usually narrow and acute but more rarely triangular. Peduncle of petiole long, the node in profile high and narrow. Sculpture on dorsum of head sparse, consisting anteriorly of a few longitudinal, widely spaced and strongly defined carina-like rugae. Posteriorly on the dorsum, behind the level of the eyes, these rugae tend to branch and to form cross-meshes so that a very loose and open rugoreticulum is present. The spaces between all these rugulae are smooth and unsculptured. Dorsal alitrunk loosely reticulate-rugose, the pedicel and gaster unsculptured. Colour uniform yellowish brown to light brown, often with the head and gaster darker in shade than the alitrunk.

The species most closely related to *carinatum* is *aspersum*, and their relationship appears to be close indeed. They are separable on details of cephalic sculpture which appear to be consistent and by the fact that they seem to be mutually exclusive as regards their respective ranges. Although this is based on relatively little material it is interesting to note that the known range of *carinatum* includes Sulawesi, New Guinea and the Aru Is whilst that of *aspersum* tends to be more easterly, occurring in the Philippines, Morotai I., Bismarck Archipelago and Solomon Is.

MATERIAL EXAMINED. SULAWESI: Mt Tangkoko-Batuangus Res. (*W. L. Brown*). NEW GUINEA: Maffin Bay (*E. S. Ross*); Humboldt Bay (*L. E. Cheesman*).

Tetramorium diligens (F. Smith) **comb. n.**

(Figs 2, 4)

Myrmica diligens F. Smith, 1865 : 73. Syntype workers, NEW GUINEA (*A. R. Wallace*) (UM, Oxford; BMNH [examined].

Xiphomyrmex diligens (F. Smith) Donisthorpe, 1932 : 473.

WORKER. TL 3·8–3·9, HL 0·92–0·94, HW 0·74–0·78, CI 80–83, SL 0·96–1·00, SI 128–129, PW 0·62–0·66, AL 1·12 (2 measured).

Mandibles very feebly striate; antennal scapes long, SI > 120. Frontal carinae extended back only to the level of the posterior margin of the eye and terminating in this vicinity. Scrobes virtually non-existent, merely a very shallow impression below the frontal carinae. Propodeal spines stout and very long, the metapleural lobes very reduced, low and broadly rounded, not dentiform, scarcely or not visible when the alitrunk is viewed in profile. Peduncle of petiole long, the node high and narrow in profile with a concave anterior face (Fig. 4). Dorsum of head mostly unsculptured, with one or two short rugulae between the frontal carinae, the median cephalic carina fading out posteriorly. Vertex unsculptured, smooth and shining. Dorsal alitrunk with a few coarse and widely spaced rugae, pedicel and gaster unsculptured. Bicoloured, the head and gaster blackish brown, the alitrunk, legs and antennae yellow. In the syntypes the petiole is yellow-brown, the postpetiole darker, almost as dark as the gaster.

Known only from the original collection, this distinctive species appears closest related to *carinatum* but in that species the head is broader, the scapes shorter, the integument more densely sculptured and the metapleural lobes are dentiform.

Two other New Guinea species, *bicolor* and *tricarinatum*, have the same distinctive coloration as *diligens*, but both of these species belong to the *bicarinatum*-group and hence have 12-segmented antennae and a dentiform sting-appendage.

Tetramorium gambogecum (Donisthorpe) **comb. n.**
(Fig. 5)

Xiphomyrmex gambogecus Donisthorpe, 1941 : 57. Holotype and paratype workers, NEW GUINEA: Japen I., Mt Eiori, 2000 ft, x.1938 (*L. E. Cheesman*) (BMNH; MCZ, Cambridge) [examined].
Xiphomyrmex gambogecus var. *flavus* Donisthorpe, 1941 : 58. Holotype worker, NEW GUINEA: Japen I., Mt Baduri, 1000 ft, viii.1938 (*L. E. Cheesman*) (BMNH) [examined]. **Syn. n.**

WORKER. TL 4·7–5·4, HL 1·08–1·14, HW 0·92–1·00, CI 84–87, SL 1·30–1·44, SI 141–148, PW 0·76–0·82, AL 1·48–1·60 (10 measured).

Mandibles striate; antennal scapes extremely long, SI > 140. Posterior extensions of frontal carinae weak, petering out and becoming indistinguishable from the sculpture behind the level of the eye. Antennal scrobes very reduced, vestigial, consisting only of a shallow impression running from the insertions to the level of the eye and sculptured throughout. Propodeal spines very long (Fig. 5), metapleural lobes reduced to low, rounded flanges, not dentiform nor prominent, invisible when the alitrunk is viewed in profile. Petiole in profile with an extremely long peduncle and a high, narrow node. Dorsum and sides of head and dorsal alitrunk with a distinct rugoreticular sculpture the meshes of which are more distinct on the head than on the alitrunk. Pedicel and gaster completely smooth and shining. Colour uniform yellow-brown to mid-brown.

This large and very distinctive species is apparently confined to New Guinea and appears to be known only from the type-series and the single specimen of its absolute synonym *flavus*.

The *tenuicrinis*-group

Antennae with 11 segments. Sting appendage spatulate and projecting at a distinct angle from the shaft. Propodeum unarmed. Sculpture very reduced, predominantly unsculptured. Petiole with anterior and dorsal faces of node united in a single shallow curve (Fig. 13).

This enigmatic little species has a very limited distribution (see below) at the extreme eastern edge of the known range of *Tetramorium* species in which the antennae have 11 segments. Its affinities are not clear but I suspect that it may be derived from the *tortuosum*-group although I have no clear evidence to support the statement.

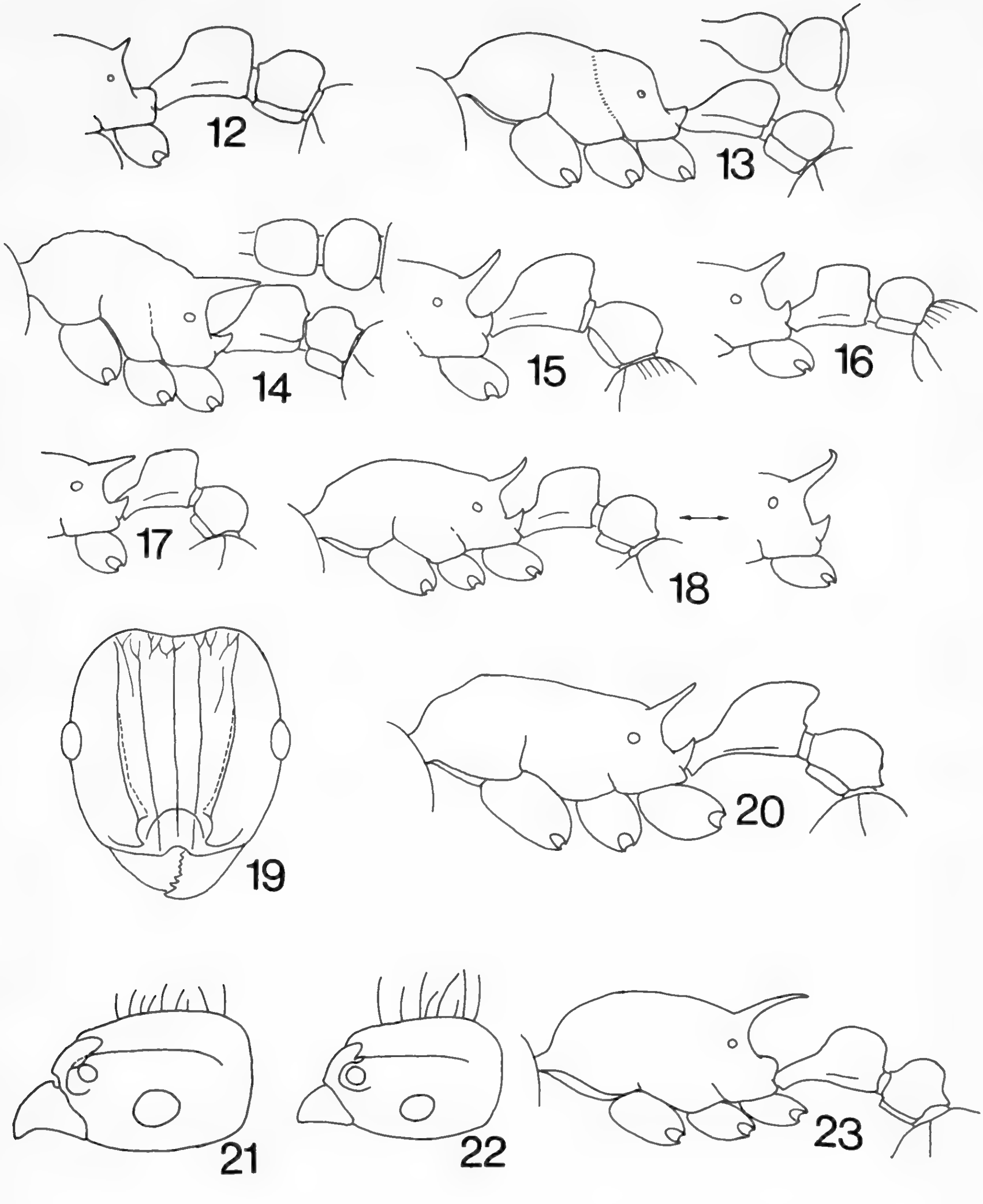
Of all the known *Tetramorium* species of the regions at present under consideration only two have the propodeum unarmed. One of these is *tenuicrinis*, the other *infraspinum* of Java. This last-named species has 12-segmented antennae, a dentiform sting appendage, and is densely sculptured; thus there is little chance of confusing the two.

Tetramorium tenuicrinis (Emery) **comb. n.**
(Fig. 13)

Xiphomyrmex tenuicrinis Emery, 1914b : 416. Holotype worker, NEW CALEDONIA: Vallée de la Ngoi (*Sarasin & Roux*) (location of type not known).

WORKER. TL 3·40–3·80, HL 0·74–0·80, HW 0·64–0·74, CI 83–90, SL 0·58–0·68, SI 85–92, PW 0·52–0·58, AL 0·88–1·02 (20 measured).

Mandibles feebly striate to virtually smooth. Frontal carinae extending well beyond the level of the posterior margins of the eyes, forming the upper boundary of the feebly developed scrobe which is scarcely more than a shallow groove, not capable of containing the entire scape. Propodeum rounded to bluntly angulate but without spines or teeth, the metapleural lobes triangular and well developed. Node of petiole in profile longer than high, the anterior and dorsal surfaces confluent through a gentle curve (Fig. 13). In dorsal view both pedicel segments subglobular. Dorsum of head with median longitudinal carina present and with one or two short rugulae on each side of it, otherwise unsculptured. Promesonotal dorsum unsculptured or with a few very faint longitudinal rugulae separated by wide shining areas; propodeal dorsum usually with a few very fine rugulae. Pedicel segments and gaster smooth and shining, unsculptured. All dorsal surfaces of head and body with numerous long, fine hairs. Colour very variable. In series examined the colour has varied from entirely clear pale yellow to entirely blackish brown, the most common intermediate pattern being head and alitrunk (and usually pedicel) blackish brown, gaster and appendages yellow. Forms also occur in which the gaster is darker in shade than the alitrunk.



Figs 12–23. *Tetramorium* workers. 12–18. Alitrunk, propodeum and pedicel structure of (12) *urbanii*, (13) *tenuicrinis*, (14) *eleates*, (15) *pacificum*, (16) *bicarinatum*, (17) *insolens*, (18) *nipponense*. 19. Head of *cynicum*. 20. Alitrunk and pedicel of *cynicum*. 21, 22. Profile of head of (21) *bicarinatum*, (22) *insolens*. 23. Alitrunk and pedicel of *politum*. Sculpture and pilosity omitted except in 19, 21, 22.

This species, known only from New Caledonia and the Fiji Islands, represents the furthest easterly penetration of *Tetramorium* species with 11 antennal segments. It is not easy to relate this form to any other 11-segmented species but its lack of propodeal armament and very reduced sculpture make it easily identifiable.

MATERIAL EXAMINED. FIJI ISLANDS: Viti Levu, 5 m, W. Korovau (*E. O. Wilson*). NEW CALEDONIA: Chapeau Gendarme (*E. O. Wilson*); Montagne des Sources (*E. O. Wilson*); Ciu, nr Mt Canala (*E. O. Wilson*); Mt Mou (*E. O. Wilson*); St Louis (*N. L. H. Krauss*).

The *angulinode*-group

Antennae with 11 segments. Sting appendage spatulate and usually with an upcurved apical portion or apical lobe. Mandibles unsculptured, smooth except for a few scattered pits from which hairs arise. Petiole thick-nodiform, usually sculptured, at least on the sides. Antennal scrobes developed, the scapes relatively short, SI 64–75. Sculpture of head and alitrunk conspicuous.

The *angulinode*-group consists of eight African species and a single species, *smithi*, which occurs outside the Ethiopian region. This small species is very widely distributed in the Oriental and Indo-Australian regions but apparently does not occur in Australia.

Tetramorium smithi Mayr

Tetramorium smithi Mayr, 1878 : 673. Syntype workers, INDIA: Calcutta (*Rothney*) (BMNH; NM, Vienna) [examined].

Tetramorium simillimum subsp. *laevinode* Forel, 1902a : 235. Holotype worker, INDIA: Calcutta (*Rothney*) (MHN, Geneva) [examined]. **Syn. n.**

Tetramorium (*Xiphomyrmex*) *smithi* var. *kanariense* Forel, 1902b : 703. Syntype workers, INDIA: Kanara (*Wroughton*) (MHN, Geneva) [examined]. **Syn. n.**

WORKER. TL 2·40–2·60, HL 0·60–0·68, HW 0·56–0·64, CI 89–97, SL 0·42–0·46, SI 69–75, PW 0·44–0·52, AL 0·68–0·76 (25 measured).

Mandibles unsculptured, smooth and shining with scattered small pits. Frontal carinae extending back beyond the level of the posterior margins of the eyes. Antennal scrobes shallow but quite broad and long enough to accommodate the scapes; the latter short, with SI $<$ 80. Pronotum in dorsal view with the corners sharply angulate. Propodeum with a pair of spines, the metapleural lobes triangular, upcurved, acute apically. Petiole in dorsal view with the node as broad as or broader than long, the postpetiole distinctly broader than long. In profile the node of the petiole a roughly rectangular block, usually slightly higher than long, with parallel and near-vertical anterior and posterior faces, and the dorsum flat to feebly convex. Postpetiole lower and rounded dorsally. Head and dorsal alitrunk predominantly longitudinally rugose but with scattered, smaller cross-meshes which are not as conspicuous. Petiole usually sculptured dorsally, only very rarely with this sculpture completely effaced. Postpetiole and gaster without sculpture. Hairs numerous on all dorsal surfaces. Colour light to mid-brown, usually with the gaster darker.

This small species is a member of the *angulinode*-group, otherwise confined to the Ethiopian region. Its small size, unsculptured mandibles and short antennal scapes immediately separate it from all other *Tetramorium* with 11-segmented antennae in the regions at present under consideration.

MATERIAL EXAMINED. SRI LANKA: Coragas, nr Eliy (Univ. Lond. exped.). INDIA: Cochin (*Rothney*); no loc. (ex coll. F. Smith); Travancore (*Bingham*); Ratnagar (?); Assam, Misamari (*A. C. Cole*); Bombay (*Rothney*). BHUTAN: Samchi (*C. Baroni Urbani*). BURMA: Mandalay (*N. N. Myaing*). THAILAND: Bangkok (*H. Hillman*). VIETNAM: Saigon, Jardin Bot. (*R. H. Crozier*). WEST MALAYSIA: Malaya, Kuala Lumpur (*B. Bolton*). BORNEO: Timur Sengata R. (*J. Kurland*). SULAWESI: N.E., Tanete, Balampesoang For. (*W. L. Brown*).

The *fergusoni*-group

Antennae with 12 segments; sting appendage spatulate. Frontal carinae short, ending before level of eyes. Antennal scrobes absent. Propodeal spines long, peduncle of petiole long (Figs 31, 32).

A very easily characterized group containing at present only a single species, *fergusoni*, known only from the type-collection made in India. The unique combination of 12-segmented antennae and spatulate sting appendage is not encountered in any other species in the Oriental, Indo-Australian or Australian faunas. This condition does, however, occur in some African species, as discussed following the description of *fergusoni*.

Tetramorium fergusoni Forel
(Figs 31, 32)

Tetramorium fergusoni Forel, 1902a : 234. Syntype workers, INDIA: Travancore, lviii, 76 (*Ferguson*) (MHN, Geneva; BMNH) [examined].

WORKER. TL 2·8–3·0, HL 0·68–0·70, HW 0·66–0·68, CI 97, SL 0·46–0·50, SI 70–74, PW 0·44–0·46, AL 0·76–0·78 (2 measured).

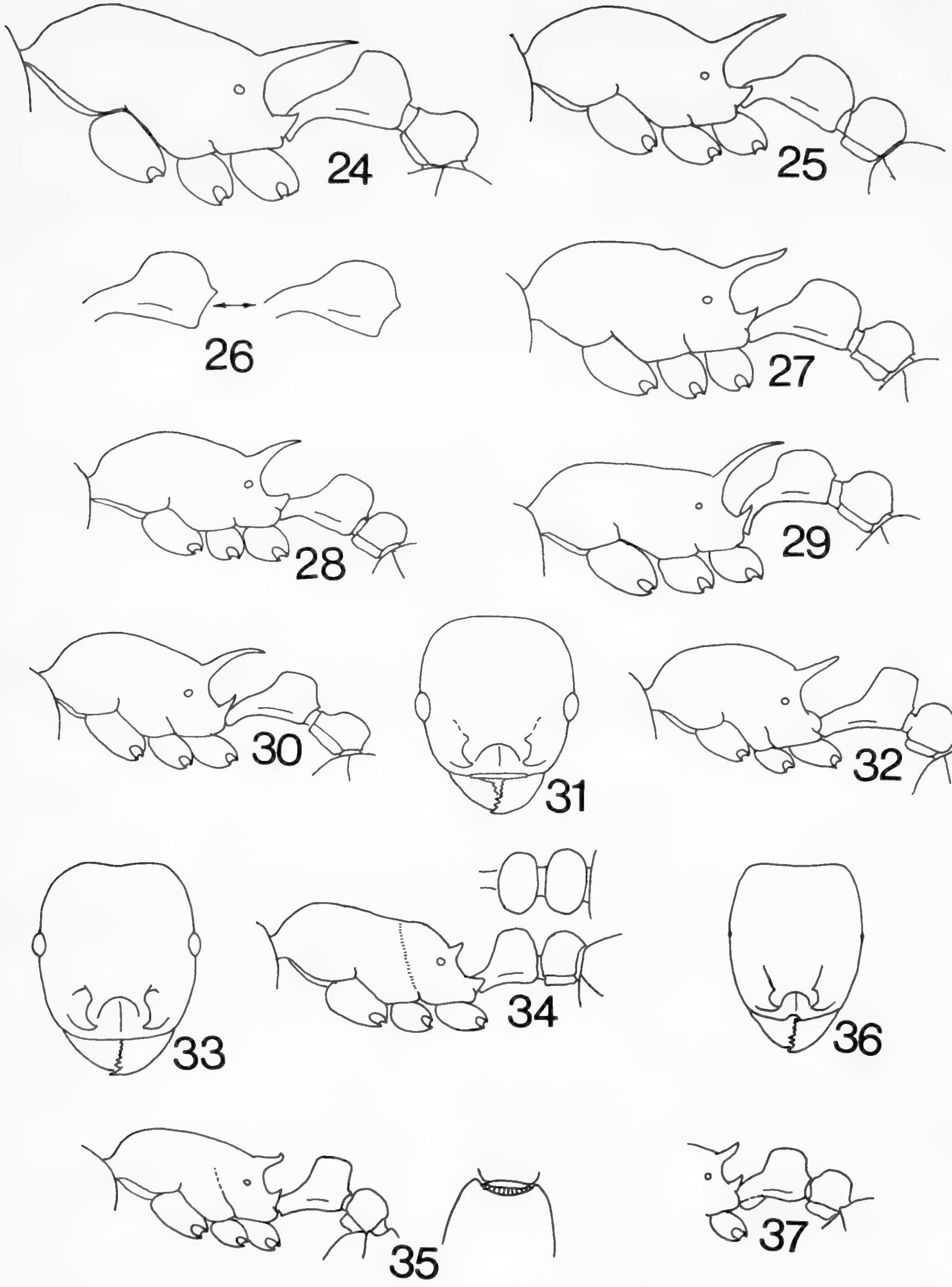
Mandibles striate; anterior clypeal margin entire and the median portion equipped with a narrow but quite distinct lamelliform apron or flange. Median portion of clypeus flat. Frontal carinae very short, ending just behind the level of the posterior margin of the clypeus. A few weak rugulae may arise from the apices of the frontal carinae and these are directed strongly laterally, the most posterior of them directed towards the midlength of the inner margin of the eye. Antennal scrobes completely absent. Maximum diameter of eyes *c.* 0·14. Propodeal spines in profile stout, quite long, acute and more or less straight; metapleural lobes low and rounded. Petiole in profile with a long anterior peduncle and a high, quite narrow and roughly rectangular node. In dorsal view both nodes distinctly broader than long. Lamelliform appendage of sting spatulate and in line with the long axis of the sting shaft. Dorsum of head with widely spaced but quite numerous straight, feeble, longitudinal rugulae, spaces between them shining. Dorsal surfaces of alitrunk and petiole mostly shining but with faint scattered rugulation; dorsum of postpetiole and entire gaster unsculptured. Short erect or suberect hairs numerous on all dorsal surfaces of head and body, and also on the leading edges of the scapes and the dorsal (outer) surfaces of the middle and hind tibiae. Some hairs on dorsum of body flattened from side to side. Colour uniform orange-yellow.

Known only from the type-series, this species is unique in the tetramoriine fauna of the regions at present under consideration as it is the only one to have 12-segmented antennae matched with a spatulate sting appendage. In the Ethiopian region two species-groups (*squaminode*-group and *grassii*-group) show this combination, but in both of these the frontal carinae tend to be strongly developed, and in the former group the petiole node is markedly squamiform. Thus *fergusoni* stands quite alone at the present time, an obscure and poorly known species whose affinities are not at all apparent.

The *caespitum*-group

Antennae with 12 segments. Sting appendage triangular or dentiform. Anterior clypeal margin entire. Frontal carinae short, sometimes virtually absent, never extending back as far as the posterior margins of the eyes, generally much shorter. Antennal scrobes absent. Eyes usually at about the midlength of the sides of the head. Metanotal groove almost always impressed in profile, even if only weakly so. Propodeal spines short, often dentiform, sometimes reduced to tubercules. Nodes of both petiole and postpetiole in dorsal view at least as broad as long, usually distinctly broader than long. Basal angles of first gastral tergite not projecting as a pair of tubercles or horns. Scapes and hind tibiae dorsally without long, erect or suberect hairs but often with suberect or subdecumbent pubescence. Sculpture of head of fine, regular longitudinal rugulation or reduced, in some species the head virtually unsculptured.

This is the dominant and only endemic group of *Tetramorium* in the Palaearctic region and most of its species are restricted to that region. One or two species occur in the Ethiopian region proper and a single species (*nursei*) occurs in the northern Oriental region. At the far eastern end of the Palaearctic region it is possible that *T. caespitum* (L.) and perhaps some of its close relatives may overlap the regional boundaries and occur in the northern strip of the Oriental region, just as a few species which are properly Oriental in distribution (but not of *caespitum*-group) may occur in the southern portion of the Palaearctic region. Such overlaps by *caespitum* into the Oriental region are ignored in this paper and will be dealt with in the section dealing with the Palaearctic fauna.



Figs 24–37. *Tetramorium* workers. 24, 25. Alitrunk and pedicel of (24) *wagneri*, (25) *salomo*. 26. Variation of petiole shape in *sculptatum*. 27–30. Alitrunk and pedicel of (27) *navum*, (28) *rigidum*, (29) *etiolatum*, (30) *basum*. 31. Head of *fergusoni*. 32. Alitrunk and pedicel of *fergusoni*. 33. Head of *nursei*. 34. Alitrunk and pedicel of *nursei*. 35. Alitrunk, pedicel and shape of base of gaster in *inglebyi*. 36. Head of *myops*. 37. Propodeum and pedicel of *myops*. Sculpture and pilosity omitted.

Tetramorium nursei Bingham
(Figs 33, 34)

Tetramorium nursei Bingham, 1903 : 181 fig. 67. Syntype workers, PAKISTAN: N.W. Frontier, Quetta, 4·02 (*Nurse*) (BMNH) [examined].

WORKER. TL 3·0–3·2, HL 0·74–0·80, HW 0·66–0·74, CI 89–92, SL 0·56–0·60, SI 81–85, PW 0·44–0·48, AL 0·88–0·94 (4 measured).

Mandibles striate, anterior clypeal margin entire. Frontal carinae very short, ending at the posterior level of the depression accommodating the antennal insertions. Antennal scrobes absent. Maximum diameter of eyes *c.* 0·14. Occipital margin of head shallowly concave in full-face view, the sides of the head feebly convex. With the alitrunk in profile the site of the metanotal groove feebly impressed. Propodeal spines minute, triangular and dentiform. Metapleural lobes short and broadly triangular. Petiole in profile high and relatively narrow, the height of the tergal portion greater than the length of the dorsum. In dorsal view both petiole and postpetiole distinctly broader than long. Dorsum of head largely unsculptured, with some very fine, faint longitudinal rugulae medially and a few stronger rugulae between the eye and the antennal insertion. Dorsal alitrunk mostly unsculptured but the anterior pronotum with some superficial punctulation and elsewhere with sparse, very faint, almost effaced superficial shagreening. Dorsal surfaces of petiole, postpetiole and gaster unsculptured. All dorsal surfaces of head and body with numerous quite stout erect or suberect hairs, absent from the appendages. Colour uniform dark yellowish brown.

This species belongs to the predominantly Palaearctic *caespitum*-group and has affinity with *semilaeve* André and its allies. The taxonomy of this group has never been satisfactorily worked out although the group itself is compact and well defined (see above). This definition of the group plus the above diagnosis of *nursei* should serve to separate this species from all others in the Oriental and Indo-Australian regions, although the latter may not be sufficient to separate it from other members of the *caespitum*-group, should any more be found in these regions.

The *bicarinatum*-group

Antennae with 12 segments. Sting appendage triangular, dentate or pennant-shaped. Anterior clypeal margin convex and with a notch or impression medially, this notch better developed in some species (*bicarinatum*, *cynicum*) than in others (*pacificum*, *validiusculum*). Median portion of clypeus with three main longitudinal carinae, often without other sculpture but sometimes with another pair of carinae which are much weaker, often incomplete or broken. Mandibles variously sculptured, smooth or striate. Frontal carinae always strongly developed, reaching back almost or quite to the occipital margin. Propodeal spines always strongly developed, straight or somewhat upcurved along their length. Base of gaster never modified as in *mixtum*-group but several species with basigastral costulae present. Basic sculpture throughout the group is a rugoreticulum, variously modified amongst the constituent species, especially upon the head.

The members of this group constitute the larger, more common and more conspicuous members of the genus in the regions at present under consideration, and the group falls roughly into two complexes of species. The first complex includes *pacificum* and its allies *bicolor*, *tricarinatum*, *cynicum* and *validiusculum*. In these species there is a tendency for the mandibles to be unsculptured and the petiole is modified into a characteristic shape (Figs 15, 20). Of the five species *pacificum* has the widest range, being found throughout the Oriental and Indo-Australian regions and also appearing in northern Australia. It may occasionally be introduced into the United States (M. R. Smith, 1943). Compared to this the ranges of other species in the complex are relatively restricted; *cynicum* to the Philippines, *bicolor* and *tricarinatum* to New Guinea (the latter also occurs on New Ireland) and *validiusculum* to New Guinea and Queensland.

The second complex has three species with sculptured mandibles (*bicarinatum*, *indicum*, *nipponense*) and two with them unsculptured (*insolens*, *obtusidens*). In general these species are more widely distributed than those related to *pacificum* and their petioles are not modified as in that complex. *T. bicarinatum* occurs throughout the tropics but is absent from the Ethiopian region. It is also a common tramp species in hothouses and zoological gardens in the temperate zones. The distribution of *indicum* forms an arc around the eastern Indian Ocean from India to Java but *nipponense* has a more northerly distribution in the Oriental region. *T. obtusidens* is

known from collections in Thailand and Singapore and also from New Guinea, but I suspect that those from this last-named locality may represent a separate species. Finally, *insolens* ranges widely in the Indo-Australian region, occurs sporadically in the Oriental and also acts as a tramp species, being known from heated buildings in England and Germany. This tramp activity may account for the Oriental region captures of *insolens* also, but strangely it has not yet been recorded from Australia.

At this point I should correct a couple of errors made in part one (Bolton, 1976) of this study. The first is that under the discussion of *Tetramorium* I refer to *T. guineense*. This name is now known to be incorrect (see below) and the name *bicarinatum* should be substituted throughout. The second error is that under the discussion of subgenera *Lobomyrmex* and *Sulcomyrmex* (p. 364), I state that in some members of *guineense*-group (recte *bicarinatum*-group) the frontal carinae are short. My concept of this group has changed since that time and the species with shorter or very reduced frontal carinae are now placed in the *ornatum*-group. This in no way affects the argument for the synonymy of the subgenera as long-carinate species also occur in this group, but at this point *ornatum*-group should be read for '*guineense*- and *pacificum*-group' in part one of this study.

The *bicarinatum*-group as a whole has a very wide distribution for, apart from the ten species discussed in the present paper, an approximately equal number of species occur in the Ethiopian region.

Tetramorium bicarinatum (Nylander) **stat. rev.**
(Figs 16, 21)

Myrmica bicarinata Nylander, 1846 : 1061. Syntype workers, female, U.S.A.: California, 1840 (types lost; not in ZMU, Helsinki nor MNHN, Paris). [Synonymized to *guineense* (F.) by Roger, 1862 : 293.]

Myrmica cariniceps Guérin-Méneville, 1852 : 79. Holotype worker, DOMINICAN REPUBLIC: Santo Domingo I., 19.iv.1850 (*A. Sallé*) (ZSBS, Munich) [examined]. [Synonymy *guineense*=*cariniceps* by Roger, 1862 : 293.]

Myrmica kollari Mayr, 1853 : 283. Syntype workers, female, male, AUSTRIA: Vienna, in hothouses in botanical gardens (NM, Vienna) [examined]. [Synonymy *guineense*=*kollari* by Roger, 1862 : 293.]

Tetramorium kollari (Mayr) Mayr, 1855 : 425.

Myrmica modesta F. Smith, 1860 : 108. Syntype workers, INDONESIA: Batjan I. (=Bachian) (*A. R. Wallace*) (UM, Oxford) [examined]. [Junior homonym of *Myrmica modesta* Foerster, 1850 : 49; the synonymy *guineense*=*modesta* F. Smith by Donisthorpe, 1932 : 463.]

Myrmica reticulata F. Smith, 1862 : 33. Syntype workers, PANAMA: (*R. W. Stretch*) and GREAT BRITAIN: England, Exeter, botanic gardens (*Parfitt*) (BMNH) [examined]. [Synonymy *guineense*=*reticulata* by Roger, 1862 : 293.]

[*Myrmica guineensis* (F.) sensu Roger, 1862 : 293 (=*Myrmica bicarinata*, *Myrmica cariniceps*, *Myrmica reticulata* and *Tetramorium kollari*). Misidentification.]

[*Tetramorium guineense* (F.) sensu Mayr, 1862, 1863; Roger, 1863b and all subsequent authors (with the above included as synonyms – see discussion below). Misidentifications; not *Formica guineensis* Fabricus, 1793 : 357 nor sensu Fabricus, 1804; Latreille, 1802.]

NOTE. The species described as *Formica guineensis* by Fabricius (1793) has consistently been referred to as *Tetramorium guineense* in all publications since the early 1860s, but examination of the types of *guineensis* shows that this generic placement in *Tetramorium* is incorrect and that the correct placement is in the genus *Pheidole* Westwood, as all six type-specimens are minor workers of a small West African species of that genus. Hence *Pheidole guineensis* (F.) is the **comb. n.** for *Formica guineensis* Fabricus, 1793 : 357; LECTOTYPE and five paralectotype minor workers, GUINEA (*Dr Isert*) (UZM, Copenhagen), here designated [examined].

It is certain that when Roger (1862) equated *guineensis* with *bicarinata*, *cariniceps*, *reticulata* and *kollari* (these last four names representing a single true *Tetramorium* species), he did not see the types of *guineensis* but relied upon comparison of specimens in his possession with the rather poor original description. In point of fact true *bicarinatum* remains unknown from West Africa, the type-locality of *guineensis*, and specimens of *bicarinatum* do not completely fit Fabricius' original description of *guineensis*. In the same year as Roger's publication Mayr (1862) referred *guineensis* to *Tetramorium* and it was later referred to in indexes under this genus by both Roger (1863b) and Mayr (1863). The misidentification of the previous year was thus given an authority which it did not deserve to possess and it has since been universally

accepted, despite the fact that the types of *guineensis* do not appear to have been examined by any later workers.

Thus, with the removal of *guineensis* to *Pheidole* the next available name for this well-known tramp species is *bicarinatum* which now becomes the valid name, with the others listed above as its junior synonyms. Although this species is widely distributed and quite well known it has no particular economic importance and I can see no reason for attempting to maintain *guineense* as a *Tetramorium* by act of the International Commission.

WORKER. TL 3·4–4·5, HL 0·80–1·00, HW 0·68–0·86, CI 80–87, SL 0·54–0·68, SI 75–84, PW 0·50–0·62, AL 0·94–1·20 (114 measured).

Mandibles very finely and densely longitudinally striate; extremely rarely the striae disorganized and the mandibles appearing finely shagreened. Anterior clypeal margin with a marked median notch or impression. Median portion of the clypeus with three longitudinal carinae of about equal strength, a median and one on each side. Sometimes another carina present on each side of the median but these are very feeble by comparison and nearly always incomplete or broken. Frontal carinae strong, running back almost to the occiput and equipped above with a narrow, raised semi-translucent flange or rim. Eyes relatively large, maximum diameter *c.* 0·19–0·24 in the head width range given above, so that diameter of eye is about 0·26–0·29 × HW, the eyes prominent in full-face view. Pronotal angles sharp in dorsal view, giving the alitrunk a 'square-shouldered' appearance. Metanotal groove absent but some specimens with a shallow impression in the alitrunk outline at its approximate position. Propodeal spines in profile strong and acute, moderately long, varying from more or less straight to slightly upcurved along their length. Metapleural lobes elongate-triangular and upcurved. Petiole node in profile roughly rectangular, with parallel or almost parallel anterior and posterior faces and an evenly convex dorsum which meets each face in an angle (Fig. 16). The anterodorsal and posterodorsal angles of the node in profile are on a level as the dorsum of the node does not slope upwards posteriorly. Dorsum of head with scattered irregular longitudinal rugae with a few cross-meshes but behind the level of the eye with a strong rugo-reticulum. Ground sculpture between the rugae superficial and inconspicuous. Dorsum of alitrunk, petiole and postpetiole reticulate-rugose, the sides of the pedicel segments similarly sculptured. Gaster unsculptured for the most part but nearly always with some short, fine basal costulae on the first tergite. These may be very faint but are only rarely completely absent. All dorsal surfaces with numerous erect or suberect hairs, those projecting from the dorsum of the frontal carinae between the antennal insertions and the occipital corner relatively short (by comparison with other species of the group), shorter than the maximum diameter of the eye (Fig. 21). Head, alitrunk, petiole and postpetiole varying from light yellow-brown to bright orange-yellow, the gaster always much darker, deep brown or blackish brown.

Because of the extremely wide range, tramping behaviour and ability to establish itself in temperate-zone hothouses this species is one of the best known of the genus *Tetramorium*. Its remarkable range takes in all tropical and subtropical land masses (with the exception of the Ethiopian region), most if not all of the Pacific island systems, and numerous other islands in the Atlantic and Indian Oceans. It has also been introduced into many temperate lands but here appears capable only of surviving in constantly heated buildings.

Over this vast area the species remains extremely stable, only showing variation in intensity of sculpture, propodeal spine length and degree of curvature, slight differences in colour and node shape, and some differences in size, none of which show any geographical significance and all of which seem characteristic variations of *Tetramorium* species in general.

Of the numerous samples from the Ethiopian region which were determined as *guineense* (=*bicarinatum*) and which I have examined, not a single specimen was in fact referable to this species, but all belonged to a complex of the group apparently restricted to sub-Saharan Africa. It appears that this complex of species is capable of excluding *bicarinatum* from Africa, even in areas disturbed by man. Wherever this complex is absent, as in Madagascar and the islands of the Malagasy region, *bicarinatum* is able to establish itself. Because of this and because a number of closely related species overlap the range of *bicarinatum* in the Oriental and Indo-Australian regions I am now of the opinion that *bicarinatum* is of SE. Asian origin and not African origin as I and others originally thought (most recently Creighton, 1950; Brown, 1957; Wilson & Taylor, 1967; Bolton & Collingwood, 1975). One closely related species, *insolens*, ranges over the Pacific islands and many islands of Indonesia and the Philippines, extending its range to Sri Lanka in the west. Further north *nipponense* occurs, a sibling of *bicarinatum* which is widely dispersed in the mountains of Bhutan, south China, north Vietnam, Japan, Okinawa and Taiwan.

A very small relative, *obtusidens*, is known from collections in Thailand, Singapore and New Guinea but is a much less conspicuous species than those mentioned previously; and finally *indicum* ranges widely in the Oriental and the Indo-Australian regions. Characters separating *bicarinatum* and *insolens* are tabulated under the latter name; those separating *nipponense* are summarized in the key and discussion of that species; similarly with *indicum*.

MATERIAL EXAMINED. MADAGASCAR: Perinet (*W. L. Brown*). SEYCHELLE IS: Frigate I. (*U. Müller*); Cargados (*J. S. Gardiner*). CHAGOS ARCHIPELAGO: Eagle I. (*M. J. D. Hirons*); Diego Garcia (*A. M. Hutson*). COSMOLEDO IS: Menai I. (*B. Cogan & A. M. Hutson*). INDIA: Kanara (*Aitken & Wroughton*); Assam, Misamari (*A. C. Cole*). SRI LANKA: Maha-Oya distr. (*R. Winney*); Udugalla (*K. L. A. Perera*); Laxapathiya (*K. L. A. Perera*); Penadura (*K. L. A. Perera*); Galle distr., Udugama (*A. E. Stubbs*); no loc. (*Uzel*). PAKISTAN: no loc. (coll. Agric. Dept.). BHUTAN: Punakha (*C. Baroni Urbani*); Phuntsholing (*C. Baroni Urbani*). CHINA: Foochow (*F. Silvestri*); Hainan I. (*L. Gressitt*). BURMA: Mandalay (*Nyo Nyo Myaing*). ANDAMAN IS: Stewart Sound (*G. Rogers*). WEST MALAYSIA: Malaya, Gombak (*R. Crozier*); Kedah (*E. S. Ross & D. Q. Cavagnaro*); Gunong Jerai (*G. H. Lowe*); Sg. Patani (*G. H. Lowe*). CHRISTMAS I. (*C. W. Andrews*). SUMATRA: Takengon (*G. Fairchild*). SUMBA: Laora (*Dammermann*). JAPAN: Chichi-Jima I., Ogasahara (*M. Tanaka*); Kagoshima Pref., Tanegashima (*M. Tanaka*); Iriomote I., Komi (*M. Tanaka*); Okinawa I., Hedo (*G. E. Bohart*); Nozato (*C. Parsons*); Chinen (*C. Parsons*), Shido (*F. G. Werner*); Loochoo I. (*L. Gressitt*). TAIWAN: Kyukyokudo (*K. Sakimura*), Bantan (*K. Sakimura*); Taihoku (*P. Takahashi*); Funkiko (*F. Silvestri*). PHILIPPINES: Manila (*R. Thaxter*); no loc. (*L. E. Griffin*); Dumaguete (*J. W. Chapman*); Horns of Negros (*J. W. Chapman*); Los Banos (*R. Thaxter*); Baguio (*J. W. Chapman*); Samar (*McGregor*); Los Banos (*L. B. Uichunco*). PALAWAN IS: Binaluan (*G. Boettcher*). NEW GUINEA: Maffin Bay (*E. S. Ross*); Mt Nomo (*L. E. Cheesman*). NEW BRITAIN: Lindenhafen (*B. A. O'Connor*). SOLOMON IS: Santa Cruz I. (*R. A. Lever*); Three Sisters I. (*R. A. Lever*); Malaita I. (*M. Willows*). AUSTRALIA: Queensland, Townsville (*F. P. Dodd*); Q., Cairns (*E. B. Britton*); Q., Cairns (*W. M. Wheeler*); Q., Capricorn I. (*F. A. Rodway*); Q., Redlynch (no coll.); Q., Mackay (*R. E. Turner*); Q., Kuranda (*F. P. Dodd*); Q., Kuranda (*W. M. Wheeler*); Q., Montville (*W. L. Brown*); Q., Ravenshoe (*Darlington*); Q., Rotnest I. (*L. Glauert*); Sydney (*H. Ashton*); Northern Territory, Rutherford (*H. B. Weiss*). LOYALTY IS: Maré (*B. Malkin*). NEW HEBRIDES: Erromanga (*L. E. Cheesman*); Malekula (*L. E. Cheesman*); Malekula (*B. Malkin*). FIJI IS: Vanua Balava (*H. S. Evans*); Suva (*H. W. Simmonds*); Nausori (*R. Vietch*); Nasoqo (*W. M. Mann*); Suva (*W. M. Wheeler*); Nadarivatu (*W. M. Mann*); Suene (*W. M. Mann*); Viti Levu (*N. L. H. Krauss*). WALLIS IS: Nuku Hifala I. (*G. Hunt*); Nuku Tapu I. (*G. Hunt*). FUTUNA IS (*G. Hunt*). SAMOAN IS: Upolu, Apia (*H. Swale*); Upolu, Malololelei (*P. A. Buxton*); Apia (*Buxton & Hopkins*); Afiamalu (*O. H. Swezey*); Tapatapao (*E. C. Zimmermann*); Tapatapao (*O. H. Swezey*); Tutuila (*E. C. Zimmermann*); Tutuila (*O. H. Swezey*); Tutuila (*D. T. Fullaway*); Pago Pago (*W. M. Wheeler*). TOKELAU IS (*E. H. Bryant*). TONGA IS: Tongatabu I. (*N. L. H. Krauss*). SOCIETY IS: Opoa (*N. L. H. Krauss*); Tahiti (*L. E. Cheesman*). MARQUESAS IS: Nuka-hiva (*L. E. Cheesman*); Fatu-hiva (*L. E. Cheesman*). MARIANA IS: Saipon I. (*H. S. Dybas*); Saipan (*N. L. H. Krauss*); Saipan (*R. M. Bohart*); Saipan (*R. K. Enders*); Pagan (*Yasu. et Yoshi.*); Guam (*N. L. H. Krauss*); Guam (*Bohart & Gressitt*). CAROLINE IS: Yap I. (*R. J. Goss*); Palau I. (*J. L. Gressitt*); Mogmog Is (*N. L. H. Krauss*); Woleia I. (*N. L. H. Krauss*); Tobi I. (*N. L. H. Krauss*); Fasserai I. (*N. L. H. Krauss*); Truk I. (*Yasu. et Yoshi*); Truk I. (*R. W. L. Potts*); Sonsorol I. (*N. L. H. Krauss*). AUSTRAL IS: Rapa I. (*A. M. Stokes*); Rapa I. (*Zimmermann*); Rimatara I. (*A. M. Stokes*). GILBERT IS: Tarawa (*E. S. Brown*); Butaritan (*N. L. H. Krauss*); Tarawa (*N. L. H. Krauss*). ELLICE IS: Funafuti (*E. S. Brown*). WAKE IS: (*T. Lyons*). GALAPAGOS IS: Tower I. (*W. M. Wheeler*). BAHAMA IS: Andros I. (*W. M. Wheeler*). TRINIDAD: (*G. Murray*); Mayaro Bay (*W. M. Wheeler*). CUBA: Zaza d. Media (*W. M. Wheeler*); Pinar del Rio (*E. O. Wilson*); Cienaga de Zapata (*W. M. Wheeler*); Soledad (*N. A. Weber*); Cunagua (*H. L. Plank*); Soledad (*W. M. Wheeler*); Soledad (*C. T. & B. B. Brues*); Vinales (*W. M. Wheeler*). PUERTO RICO: Mayaquez (*M. R. Smith*); Maricao For. (*P. Darlington*); Caguso (*Wheeler*); Pico Turguino (*P. J. Darlington*); Cerro Cabras (*W. M. Wheeler*). DOMINICA: Roseau (*W. M. Wheeler*). HAITI: Ennery (*W. M. Mann*); Grande Riviere (*W. M. Mann*). PANAMA: Toboga (*L. E. Cheesman*). HONDURAS: Punta Gorda (*J. J. White*). NICARAGUA: (*W. Fluck*). VENEZUELA: Orinoco Delta

(*N. A. Weber*). GUIANA: no loc. (*G. E. Bodkin*). COLOMBIA: Buenaventura (*M. Cooper*); Arboletes Pt (*B. Mortin*); Dept. Valle, Buenaventura (*W. L. Brown*); Aracataca (*P. J. Darlington*). BRAZIL: no loc. (ex coll. F. Smith). PERU: Tingo Maria (*Brown & Sherbrooke*). U.S.A.: Texas, Laredo (*McClendon*); N.Y., Brooklyn (*W. T. Dario*); Florida, Bisc. Bay (*W. M. Wheeler*); Florida, Key Largo (*E. O. Wilson*); Wisc., Milwaukee (*C. E. Brown*). CAPE VERDE IS: Bea Vista (*L. Fea*). AZORES: Ponta Delgada (*A. Schatzmayr*). MADEIRA (*Wollaston*). GREAT BRITAIN: Edinburgh bot. gdns (ex coll. Donisthorpe); Glasgow (ex coll. Donisthorpe); Nottingham (ex coll. Donisthorpe); Stroud (*Rev. White*); Kew Gardens (*Donisthorpe*); Kew Gardens (*W. C. Crawley*); Liverpool (ex coll. Donisthorpe). HOLLAND: Amsterdam (*v. d. Wiel*).

Tetramorium bicolor Viehmeyer

Tetramorium bicolor Viehmeyer, 1913 : 39. Holotype worker, NEW GUINEA: Wareo (MNHU, Berlin) [examined].

WORKER. TL 3·6–3·8, HL 0·84–0·90, HW 0·68–0·76, CI 80–84, SL 0·64–0·72, SI 76–80, PW 0·52–0·56, AL 0·98–1·08 (2 measured).

Mandibles smooth with scattered pits. Anterior clypeal margin with a median notch or impression. Clypeus with three strong longitudinal carinae. Frontal carinae feeble but extending back almost to occiput. Median carina of head distinct only to level of posterior margins of eyes, behind this rapidly fading out or absent. Eyes prominent, maximum diameter *c.* 0·17–0·18. Pronotal corners angular in dorsal view. Metanotal groove absent. Propodeal spines long, narrow and acute, the metapleural lobes triangular and upcurved. Petiole in profile with the tergal portion longer than high, the anterior and dorsal faces united through a curve, not separated by an angle. Dorsum convex and sloping upwards posteriorly so that the posterodorsal angle is on a higher level than the anterodorsal. Head either completely unsculptured dorsally except for the median carina or at most with one or two short, fine rugulae here and there on the surface. Pronotal dorsum with a few rugae anteriorly and laterally but the middle of the pronotum and the whole mesonotum smooth and very shiny. Propodeal dorsum reticulate-rugulose. Petiole and postpetiole each with some rugae, predominantly or entirely longitudinal. Gaster unsculptured. All dorsal surfaces of head and body with abundant erect, long hairs. Colour very distinctive, the head and gaster black or blackish brown, the alitrunk, pedicel and appendages bright yellow, the colours strongly contrasting.

The construction of the petiole and general habitus shows that *bicolor* is very closely related to *pacificum* and its allies, but the reduced sculpture and distinct colouring immediately separates *bicolor*. It is one of three bicoloured (yellow and black) species occurring in New Guinea. One of these, *diligens*, belongs to the *carinatum*-group and hence is separable by its 11-segmented antennae and spatulate sting appendage. The other is *tricarinatum*, which is very closely related to *bicolor* but much more strongly sculptured, and which possesses three carinae on the cephalic dorsum between the frontal carinae, running from the posterior clypeal margin almost to the occiput.

MATERIAL EXAMINED. NEW GUINEA: Cyclops Mts, Mt Lina (*L. E. Cheesman*).

***Tetramorium cynicum* sp. n.**
(Figs 19, 20)

HOLOTYPE WORKER. TL 4·7, HL 1·10, HW 0·98, CI 89, SL 0·84, SI 95, PW 0·66, AL 1·20.

Mandibles smooth, unsculptured except for scattered pits. Anterior clypeal margin with a strongly developed median notch. Clypeus with three strong carinae on the median section, the anterior half of which slopes very steeply and is transversely concave. Frontal carinae strong, reaching back almost to the occiput and surmounted by a low, vertical flange or ridge which is semitranslucent, highest anteriorly, shallowest posteriorly. Eyes prominent, maximum diameter *c.* 0·22. Occipital margin concave medially in full-face view, the sides feebly convex. Pronotal corners angular in dorsal view; metanotal groove absent, not impressed in profile. Propodeal spines elongate, narrow and acute, feebly upcurved. Metapleural lobes triangular and acute. Petiole in profile with the tergal portion slightly higher than long; anterior and dorsal faces meeting through a curve, not separated by an angle. Dorsum convex and sloping upwards posteriorly so that the posterodorsal angle is higher than the point at which the dorsum meets the anterior face. Posterior face slightly concave so that the posterodorsal angle is prominent and over-

hangs the posterior face (Fig. 20). Postpetiole in profile strongly convex. Dorsum of head with sparse, widely scattered longitudinal rugulae without any cross-meshes but with a few anastomoses close to the occiput. Spaces between rugulae broad and smooth, almost devoid of ground sculpture; what little there is being very inconspicuous so that the head is glossy. Pronotum reticulate-rugose, the meshes breaking down centrally; mesonotum mostly unsculptured, with a few faint longitudinal rugulae; propodeum with widely spaced rugosity. Petiole and postpetiole reticulate-rugose everywhere. Gaster unsculptured. All dorsal surfaces of head and body with numerous long, erect or suberect hairs. Colour yellow-brown.

PARATYPE WORKERS. TL 4·1–4·8, HL 0·92–1·10, HW 0·82–0·98, CI 86–90, SL 0·72–0·86, SI 86–95, PW 0·54–0·66, AL 1·06–1·26 (20 measured including largest and smallest). Maximum diameter of eye *c.* 0·18–0·22 so that the maximum diameter is about 0·22–0·23 × HW. As holotype but in some specimens the propodeal spines are straight and the mesonotum completely smooth. In many specimens the median clypeal carina is absent from the steeply sloping anterior portion of the clypeus (Fig. 19).

Holotype worker, PHILIPPINES: Dumaguete, 29.iv.24 (*J. W. Chapman*) (MCZ, Cambridge).

Paratypes. PHILIPPINES: 17 workers with same data as holotype; 12 workers, Dumaguete, 1500 ft (*J. W. Chapman*); 3 workers, Dumaguete, 13.iv.27 (*J. W. Chapman*) (MCZ, Cambridge; BMNH; NM, Basle).

More material of this species is present in MCZ, Cambridge (Chapman coll.), but much of it is in rather poor condition. The localities of this material include Dumaguete, Cuernos Mts and Horns of Negros, all collected by Chapman in the Philippines.

T. cynicum appears to be derived from a *pacificum*-like ancestor but it has certainly developed far enough away from the parent stock to be regarded now as a separate species, endemic in and apparently restricted to the Philippines. In many respects *cynicum* parallels *validiusculum*, a New Guinea-based sibling of *pacificum* which seems to have developed along similar lines. However, in this species the clypeal notch is feeble, the clypeus does not have a very steep anterior half and this portion of the clypeus is not or only extremely feebly transversely concave. The petiole node is longer and lower in *validiusculum* and the posterodorsal angle, though pronounced, does not appreciably overhang the posterior face of the node. All in all, *cynicum* and *validiusculum* appear to be two species descended from the same basal stock, but the first has been more profoundly modified than the second, away from the characters shown by modern *pacificum*.

Tetramorium indicum Forel **stat. n.**

Tetramorium guineense var. *indica* Forel, 1913 : 81. Syntype workers, females, SUMATRA: Tandjang Slanat and Bah Boelian (*Buttel-Reepen*) (MNH, Geneva) [examined].

WORKER. TL 3·7–4·3, HL 0·84–0·96, HW 0·74–0·88, CI 85–92, SL 0·60–0·72, SI 78–85, PW 0·52–0·62, AL 1·00–1·16 (40 measured).

Mandibles finely and usually quite faintly striate, sometimes the striation effaced in places. Clypeus with a notch or impression medially in the anterior margin, the median portion of the clypeus with three strong longitudinal carinae. Frontal carinae long and strong, extending back almost to the occiput. Eyes of moderate size, maximum diameter *c.* 0·18–0·21, so that the eye is about 0·23–0·25 × HW. Pronotal corners angular in dorsal view. Propodeal spines usually quite short and stout, more rarely elongated, usually approximately straight, elevated but not upcurved along their length nor abruptly and strongly upcurved at their apices. Metapleural lobes triangular, acute and slightly upcurved. Petiole in profile with the anterior face slightly shorter than the posterior so that the anterodorsal angle is on a lower level than the posterodorsal. Rugose sculpture of dorsal head longitudinal to level of posterior margins of eyes, without cross-meshes; behind this a rugoreticulum is present. Dorsal alitrunk reticulate-rugose as are the pedicel segments, although in some the postpetiole dorsum tends to be predominantly longitudinally rugose. Gaster usually with vestiges of basal costulae on the first tergite, more rarely unsculptured. All dorsal surfaces of head and body with numerous erect or suberect hairs, the longest of those projecting dorsally from the frontal carinae behind the antennal insertions longer than the maximum diameter of the eye. Colour uniform light brown to mid-brown, rarely with the gaster slightly darker than the alitrunk.

Like *nipponense* this species is very close to *bicarinatum*, but is separable by the characters shown in the key, especially the fact that the long hairs arising dorsally from the frontal carinae are consistently shorter than the maximum diameter of the eye in *bicarinatum*, and longer in *indicum*. The eye itself is larger in *bicarinatum*, its maximum diameter being 0·26–0·29 × HW

as opposed to 0·23–0·25 × HW in *indicum*. Colour pattern is also of value in separating the two as in *bicarinatum* the gaster is always conspicuously darker than the head and alitrunk, whereas in *indicum* the colour is usually uniform throughout; examples with the gaster slightly darker than the rest of the body are known but they are uncommon.

Without doubt the closest relative of *indicum* is *nipponense* and the best characters for separating this pair are those given in the key. The fact that the eyes of *nipponense* tend to be slightly larger in material examined may not be significant in the long run. In general the ranges of these two species tend to be mutually exclusive, but both forms occur in Bhutan as has been shown by the recent collections made there by Cesare Baroni Urbani. The range of *nipponense* appears to be an upland or mountain one, and the species occurs in a broad belt from Bhutan eastwards across southern and south-eastern China, northern Vietnam, Japan, Okinawa and Taiwan. On the other hand, the distribution of *indicum* occupies an arc around the eastern end of the Indian Ocean from India to Java, in the forested zones.

MATERIAL EXAMINED. SRI LANKA: Ratnapura (*E. O. Wilson*); Colombo (*E. O. Wilson*); Yakkala (*K. L. A. Perera*). INDIA: Kerala State, Kottiyoor (*A. B. Soans & W. L. Brown*). ANDAMAN Is: N. Reef I. (*G. Rogers*). BHUTAN: Phuntsholing (*C. Baroni Urbani*); Khala (*C. Baroni Urbani*); Samchi (*C. Baroni Urbani*). BURMA: no loc. (*G. B. King*). JAVA: Buitenzorg (*Verbeek*); Semarang (*L. G. E. Kalshoven*); Rembang (*L. G. E. Kalshoven*).

Tetramorium insolens (F. Smith)
(Figs 17, 22)

Myrmica insolens F. Smith, 1861 : 47. Holotype female (not worker), SULAWESI: Menado (*A. R. Wallace*) (UM, Oxford) [examined].

Tetramorium insolens (F. Smith); Donisthorpe, 1932 : 468.

Tetramorium guineense var. *macra* Emery, 1914b : 415. Syntype worker, NEW CALEDONIA: Koné, 8.viii.1911 (*Sarasin & Roux*) (NM, Basle) [examined]. **Syn. n.**

Tetramorium melanogyna Mann, 1919 : 345, fig. 28. Syntype workers, female, SOLOMON Is: Ugi, Pawa, 1916 (*W. M. Mann*); and Three Sisters, Malapaina, 1916 (*W. M. Mann*) (MCZ, Cambridge) [examined]. **Syn. n.**

Tetramorium pacificum var. *wilsoni* Mann, 1921 : 460. Syntype workers, FIJI Is: Viti Levu, Nausori, Waiyanitu, 1915–16 (*W. M. Mann*) (MCZ, Cambridge) [examined]. **Syn. n.**

Tetramorium melanogyna var. *pallidiventre* Wheeler, 1934b : 177. Holotype worker, SOLOMON Is: Bellona I., 19.vi.1933 (*M. Willows*) (CAS, San Francisco) [examined]. **Syn. n.**

WORKER. TL 3·3–4·0, HL 0·78–0·94, HW 0·68–0·84, CI 84–88, SL 0·56–0·68, SI 78–86, PW 0·50–0·62, AL 0·92–1·08 (40 measured).

Mandibles smooth and shining, unsculptured except for scattered pits. Anterior clypeal margin with a median notch or impression; median portion of clypeus with three strong longitudinal carinae. Frontal carinae long and strong, extending back almost to the occiput. Eyes of moderate size, maximum diameter *c.* 0·18–0·20, about 0·23–0·26 × HW. Pronotal corners in dorsal view angular. Propodeal spines long and stout, generally somewhat upcurved along their length, more rarely with the extreme apex of each spine suddenly upcurved. Metapleural lobes triangular, acute, somewhat upcurved. Petiole node in profile with anterior and posterior faces approximately parallel, the dorsum convex and rising slightly posteriorly so that the anterodorsal angle is on a slightly lower level than the posterodorsal angle, the latter angle usually distinctly sharper than the former, which has a tendency to be rounded. Dorsum of head to level of eyes with sparse longitudinal rugulae with a few cross-meshes and a fine but fairly conspicuous ground sculpture. Behind the level of the eyes the head reticulate-rugose. Dorsal alitrunk with an irregular rugo-reticulum which is usually strongest on the pronotum. Petiole and postpetiole reticulate-rugose both laterally and dorsally. Gaster unsculptured. All dorsal surfaces of head and body with abundant long erect or suberect hairs, those situated in a row on the upper surfaces of the frontal carinae between antennal insertion and occiput very long, distinctly longer than the maximum diameter of the eye (Fig. 22). Colour varying from clear pale yellow to light orange-brown, usually with the gaster distinctly lighter in shade than the head and alitrunk. More rarely the ant is uniformly coloured and only very rarely indeed is the gaster slightly darker in shade than the alitrunk.

In collections from the island systems of the Pacific Ocean this species has in the past been much confused with *bicarinatum*. The most recent survey by Wilson & Taylor (1967) did not

differentiate the two species, although both were present in the material examined. At first glance the two appear quite similar, but are separated by the following differences:

bicarinatum	*insolens*
Mandibles covered with fine, dense striation or shagreening	Mandibles smooth and very shiny, with a few scattered pits
Long hairs arising from margin of frontal carina behind antennal insertion and in front of occipital corner shorter than maximum eye diameter (Fig. 21)	Long hairs arising from margin of frontal carina behind antennal insertion and in front of occipital corner longer than maximum eye diameter (Fig. 22)
Gaster always much darker in colour than head and alitrunk	Gaster usually lighter or same shade as head and alitrunk, only rarely slightly darker
Anterodorsal and posterodorsal angles of petiole in profile approximately on a level (Fig. 16)	Anterodorsal and posterodorsal angles of petiole in profile not on a level, the latter higher than the former (Fig. 17)
Eyes relatively slightly larger, maximum diameter *c.* 0·26–0·29 × HW	Eyes relatively slightly smaller, maximum diameter *c.* 0·23–0·26 × HW

This species is capable of surviving in permanently heated buildings in the temperate zone. I have seen samples from England and Germany, both of which were determined as *guineense* (now *bicarinatum*), so it is possible that other misidentified introductions of *insolens* have occurred, at present unrecognized. Up to the present *insolens* has not been recorded from Australia, but I have included it in the key to that fauna for completeness, as I feel sure that this widespread species will be found to occur in eastern Australia, if only as an introduction.

MATERIAL EXAMINED. SRI LANKA: Ratnapura (*E. O. Wilson*). FLORES: Wodeng (*W. L. Brown*). PHILIPPINES: Dumaguete (*J. W. Chapman*), Mailum (*F. del Rosario*); Mt Maquiling (*F. X. Williams*). NEW GUINEA: Nadzab (*E. O. Wilson*); Finsch Harbour (*N. G. L. Wagner*); Azeriia Plantation (*Szent-Ivany*); Finschhafen (*E. S. Ross*); Cyclops Mts, Sabron (*L. E. Cheesman*). SOLOMON IS: Wainoni Bay (*W. M. Mann*); Ugi (*W. M. Mann*); Malaita (*E. S. Brown*). NEW CALEDONIA: Dumbea Valley (*N. L. H. Krauss*). NEW HEBRIDES: Espiritu Santo (*E. O. Wilson*); Malekula (*B. Malkin*); Santo (*L. E. Cheesman*); Erromanga (*L. E. Cheesman*). FIJI IS: Suva (*Ehrhorn*); Viti Levu (*E. O. Wilson*); Taveuni (*H. S. Evans*); Nausori (*R. Veitch*). WALLIS IS: Uvea (*G. Hunt*). FUTUNA IS: Leava (*G. Hunt*). SAMOAN IS: Pango Pango (*E. C. Zimmermann*); Savaii (*N. L. H. Krauss*); Tutuila (*E. C. Zimmermann*); Upolu (*E. C. Zimmermann*); Tutuila (*T. Fullaway*); Upola (*Buxton & Hopkins*). CAROLINE IS: Yap I. (*J. L. Gressitt*). LOYALTY IS: Maré, Congeite (*B. Malkin*). NIEU I. (*A. E. Eyles*). GREAT BRITAIN: England, Rawdon, orchid house (*R. B. Benson*). GERMANY: Leipzig, zoological gdns (ex coll. Donisthorpe).

Tetramorium nipponense Wheeler **stat. n.**

(Fig. 18)

Tetramorium guineense subsp. *nipponense* Wheeler, 1928 : 115. Syntype workers, JAPAN: Nagasaki, Michino-o, 3.vi.25 (*F. Silvestri*) (MCZ, Cambridge) [examined].

WORKER. TL 3·3–3·7, HL 0·72–0·88, HW 0·62–0·78, CI 84–90, SL 0·54–0·64, SI 80–88, PW 0·48–0·58, AL 0·86–1·04 (20 measured).

Mandibles finely and densely longitudinally striate. Anterior clypeal margin with a distinct median notch or impression; median portion of clypeus with three strong longitudinal carinae. Frontal carinae strong, reaching back almost to the occipital margin. Eyes moderate, maximum diameter *c.* 0·18–0·20, about 0·25–0·28 × HW. Pronotal corners in dorsal view angulate. Propodeal spines in profile elongate and narrow, either upcurved along their whole length or abruptly and strongly upcurved at their apices, or both. Metapleural lobes elongate-triangular, narrow, acute and somewhat upcurved, or with their apical portions more or less spiniform. Petiole node in profile with the anterior face shorter than the posterior so that the dorsal surface slopes slightly upwards posteriorly and the posterodorsal angle is on a higher level than the anterodorsal. Dorsum of head with a loose rugoreticulum, cross-meshes occurring as far forwards as the level of the anterior margins of the eyes or in some cases approaching the posterior border of the clypeus. Dorsal alitrunk and dorsum and sides of pedicel segments reticulate-rugose, but

in some specimens sculpture of postpetiole dorsum is predominantly or entirely longitudinal. Base of the first gastral tergite usually with vestiges of costulae, absent in some specimens, otherwise gaster unsculptured. Numerous long, erect or suberect hairs present on all dorsal surfaces of head and body, the longest of those projecting from the dorsum of the frontal carinae longer than the maximum diameter of the eye. Colour uniform yellowish brown, rarely with the gaster very slightly lighter or darker than the alitrunk.

T. nipponense overlaps the range of the related *bicarinatum* in the northern parts of the Indo-Australian and Oriental regions. The two are separated by the respective lengths of the long hairs arising from the frontal carinae, which are longer than the maximum diameter of the eye in *nipponense*, shorter in *bicarinatum*. Also, the gaster in *bicarinatum* is always conspicuously darker in colour than the head and alitrunk whilst in *nipponense* the entire ant tends to be unicolorous, with only slight variation in gastral colour. Finally, the petiole node in *bicarinatum* tends to have the anterior and posterior faces about equal in length in profile so that the antero- and postero-dorsal angles are approximately on a level, whereas in *nipponense* the posterior face is somewhat higher than the anterior so that the angles are not on the same level, the posterodorsal being higher. This node form is also encountered in *insolens*, which overlaps the eastern end of the range of *nipponense*, but in *insolens* the mandibles are not striated. Finally, the closely related *indicum* is best separated by the characters noted in the key.

MATERIAL EXAMINED. BHUTAN: Khala (*C. Baroni Urbani*); Phuntsholing-Timphu (*C. Baroni Urbani*). CHINA: Foochow (*L. Gressitt*); Foochow (*Kellogg*); Kuliang (*S. F. Light*); Hsinching Hsien, Mou Man Shan (*W. L. Brown*); Szechwan Prov., Shwangliu (*W. L. Brown*); Szechwan Prov., Hsinching (*W. L. Brown*). VIETNAM: Tocco (*F. Silvestri*). JAPAN: Kochi (?); Chichijma I., Ogasawara (*M. Tanaka*); Okinawa (*F. G. Werner*). TAIWAN: Funkiko (*F. Silvestri*); Kuan Tao Chi (*A. C. F. Hung*); Sozan (*L. Gressitt*); Sakahan (*L. Gressitt*); Hassenzan (*L. Gressitt*); Bukai (*L. Gressitt*); Musha (*L. Gressitt*); Rokki (*L. Gressitt*); Hori (*L. Gressitt*).

Tetramorium obtusidens Viehmeyer

Tetramorium obtusidens Viehmeyer, 1916 : 138, fig. 6. Syntype females, SINGAPORE: Jurong Road (*H. Overbeck*) (MNHU, Berlin) [examined].

WORKER. TL 2·9–3·1, HL 0·70–0·76, HW 0·58–0·62, CI 81–86, SL 0·48–0·52, SI 80–86, PW 0·44–0·48, AL 0·84–0·94 (8 measured).

Mandibles unsculptured, smooth and shining except for small scattered pits from which hairs arise. Clypeus with a shallow median impression, the median portion with three strong longitudinal carinae. Frontal carinae strong, extending back almost to occiput. Eyes of moderate size, *c.* 0·15–0·16 or about 0·25–0·26 × HW. Propodeal spines of moderate length, usually quite stout, acute, not or only very slightly upcurved along their length; metapleural lobes narrow and acute. Petiole node in profile with the tergal portion very slightly longer than high and the posterior face slightly higher than the anterior so that the convex dorsum slopes feebly upwards posteriorly and the posterodorsal angle is on a slightly higher level than the anterodorsal. Dorsum of head primarily longitudinally rugulose but with a few cross-meshes occurring as far forward as the level of the anterior margins of the eyes. Occipital region with a fine rugoreticulum. Dorsal alitrunk and dorsum and sides of petiole reticulate-rugose, the latter less strongly so than the former. Postpetiole with fine longitudinal rugulae dorsally but in some specimens these are almost effaced. Gaster smooth but usually with very faint traces of basal costulae on the first tergite. All dorsal surfaces of head and body with numerous erect or suberect hairs, those arising from the frontal carinae dorsally at least as long as the maximum diameter of the eye, usually longer. Colour uniform clear pale yellow.

At first glance this species resembles a very small, pale-coloured specimen of *insolens*, to which it appears to be closely related. It differs in being smaller (compare the measurements), somewhat more strongly sculptured on the head and has a rather reduced petiole node when compared to *insolens*. Its sporadic but wide distribution is peculiar and I suspect that the name *obtusidens* may conceal more than one valid species; in particular I think that the New Guinea sample may be a good species. However, as collections are at present so scanty this is conjecture. In the MCZ, Cambridge collection are a number of females of a species close to *obtusidens* but which have the

mandibles strongly striate. They originate in Queensland and probably represent an as yet undescribed member of the group.

MATERIAL EXAMINED. SINGAPORE: Bukit Timah Forest (*D. H. Murphy*). THAILAND: Nong Hoi (*D. Jackson*). NEW GUINEA: Brown Riv., Karema (*E. O. Wilson*); Lai (*E. O. Wilson*); Huon Peninsula, L. Busu Riv. (*E. O. Wilson*).

Tetramorium pacificum Mayr
(Fig. 15)

Tetramorium pacificum Mayr, 1870 : 972, 976. Syntype workers, female, TONGA: Tongatabu (NM, Vienna; BMNH) [examined].

Tetramorium scabrum Mayr, 1878 : 672. Holotype worker, BORNEO: no. 305, 242 (*Xanthus*) (TM, Budapest) [examined]. **Syn. n.**

Tetramorium pacificum var. *subscabrum* Emery, 1893 : 246. Syntype workers, SRI LANKA: Kandy and Colombo (*E. Simon*) (MHN, Geneva) [examined]. **Syn. n.**

WORKER. TL 3·7–4·6, HL 0·86–1·10, HW 0·72–1·02, CI 83–90, SL 0·62–0·82, SI 79–87, PW 0·54–0·68, AL 1·04–1·30 (45 measured).

Mandibles usually unsculptured except for small hair-pits, but in some populations the mandibles with striation of varying intensity, though usually faint. Anterior clypeal margin with a median notch or impression; median portion of clypeus with three strong longitudinal carinae. Frontal carinae long and strongly developed, always reaching back well beyond the eyes, usually approaching the occipital margin. Maximum diameter of eye *c.* 0·18–0·21, about 0·22–0·25 × HW. Propodeal spines long and acute, usually narrow and often somewhat upcurved along their length. Metapleural lobes acute and upcurved, usually broad. Petiole in profile characteristically shaped, with the posterior face longer than the anterior so that the convex dorsum slopes upwards posteriorly and the posterodorsal angle is higher than the anterodorsal. Anterior face and dorsum confluent through a curve (Fig. 15). Sculpture variable in density and intensity. On the head varying from a blanketing rugoreticulum to a system which is predominantly longitudinal, but in this latter case always with cross-meshes present from the level of the anterior margins of the eyes and always with a reticulum posteriorly, close to the occiput. Ground sculpture between the rugae superficial but quite conspicuous. Dorsal alitrunk reticulate-rugose; often the pedicel segments similarly sculptured but in some the sculpture predominantly longitudinal. First gastral tergite usually with at least traces of basal costulae; although these are often vestigial they are only rarely completely absent. Erect or suberect long hairs present on all dorsal surfaces of head and body. Colour a uniform dark brown, blackish brown or black.

One of the commonest species of *Tetramorium* in the regions at present under discussion, *pacificum* ranges over the whole of the Oriental and Indo-Australian regions and is present in northern Australia and most or all of the island systems in the Pacific Ocean. In the Philippines and New Guinea it is to some extent displaced by sibling species (*cynicum* and *validiusculum*) and also in New Guinea a few other species have arisen from *pacificum*, namely *bicolor* and *tricarinatum*, which have developed a striking coloration. A few specimens from New Guinea (in MCZ, Cambridge) are a bright golden-yellow in colour, but whether these represent another valid species or just a very aberrant population of *pacificum* remains to be seen. Suffice to say for the time being that apart from the colour these specimens do not seem separable from *pacificum* on any other grounds.

MATERIAL EXAMINED: SRI LANKA: Colombo (*W. L. Brown*); Laxapathiya (*K. L. A. Perera*); Yakkala (*K. L. A. Perera*); Dehiwala (*W. L. Brown*); Peradeniya (*E. O. Wilson*); Peradeniya (*E. E. Green*); Gilimale (*E. O. Wilson*); Ratnapura (*E. O. Wilson*); Kandy (*E. O. Wilson*); Koslanda (*R. Winney*); Bibile (*R. Winney*). BURMA: Mandalay (*C. T. Bingham*); Rangoon (*C. T. Bingham*). WEST MALAYSIA: Malaya, Cameron Highlands (*B. Bolton*); Genting Highlands (*B. Bolton*); Gombak (*B. Bolton*); Frazer's Hill (*E. S. Ross*); Pasoh Forest (*H. Watanabe*). SUMATRA: Wai Lima (*H. H. Karny*); no loc. (*A. H. G. Alston*). JAVA: Buitenzorg (*Dammermann*); no loc. (*Staudinger*); Bogor (*B. Bolton*); Bogor (*A. H. G. Alston*); Tjibodas (*B. Bolton*). BORNEO: Sarawak, Mt Penrissen (*E. Mjoberg*); Mt Poi (*E. Mjoberg*); Trus Madi Massif (*P. W. Bryant*); Bongo Mt (*J. Hewitt*). PHILIPPINES: Davao (*A. Reyes*); Lanao (*J. W. Chapman*); Cebu (*F. X. Williams*); Romblon I. (*L. Moroto*); Mt Maquiling (*C. F. Baker*); Mt Apo (*C. F. Clagg*); Luzon, Ilcos Norte (*C. S. Banks*); Dumaguete (*J. W. Chapman*); Los Banos (*F. X. Williams*); Leyte,

Tacloban (*E. S. Ross*). TAIWAN: Kuraru (*L. Gressitt*). NEW GUINEA: Port Moresby (*E. O. Wilson*). AUSTRALIA: Northern Territory, Darwin (*G. F. Hill*). NEW BRITAIN: Rabaul (*N. L. H. Krauss*). SOLOMON Is: Rennell I. (*J. D. Bradley*); Bougainville I. (*E. J. Ford*). LOYALTY Is: Tadine, Maré (*B. Malkin*). NEW HEBRIDES: Efate (*P. Greenslade*); Aoba (*B. Malkin*); Efate (*N. L. H. Krauss*); Malekula (*L. E. Cheesman*); Erromanga (*L. E. Cheesman*); Santo (*L. E. Cheesman*); Tanna (*L. E. Cheesman*); Aneityum (*L. E. Cheesman*); Efate (*P. Cachereau*). FIJI Is: Nausori (*W. M. Mann*); Somo Somo (*W. M. Mann*); Waiyanitu (*W. M. Mann*); Suva (*W. M. Wheeler*); Viti Levu (*N. L. H. Krauss*); Viti Levu (*E. O. Wilson*); Ovalau (*W. M. Mann*); Wainunu (*W. M. Mann*); Labasa (*W. M. Mann*); Vunisea (*W. M. Mann*); Nausori (*W. L. & D. E. Brown*). FUTUNA I.: Vaisei to Mt Puke (*G. Hunt*); Pointe Nord (*G. Hunt*). SAMOAN Is: Upolu, Afiamalu (*O. H. Swezey*); Pango Pango (*E. C. Zimmermann*); Tutuila (*O. H. Swezey*); Savaii (*N. L. H. Krauss*); Upolu, Tapatapao (*O. H. Swezey*); Upolu, Malololelei (*N. L. H. Krauss*); Tutuila (*D. T. Fullaway*); Apia (*H. Swale*); Savaii (*E. H. Bryan*). TONGA Is: Tongatabu (*W. Cottrell*); Eua I., Ohonua (*N. L. H. Krauss.*) SOCIETY Is: Tahiti (*A. M. Adamson*); Tahiti, Papenoo Valley (*N. L. H. Krauss*). NEW CALEDONIA: St Louis Mission (*G. Hunt*); Ciu (*E. O. Wilson*); Noumea (*E. O. Wilson*); Noumea (*N. L. H. Krauss*); Mt Mou (*E. O. Wilson*); Chapeau Gendarme (*E. O. Wilson*).

Tetramorium tricarinatum Viehmeyer **stat. n.**

Tetramorium bicolor subsp. *tricarinatum* Viehmeyer, 1914 : 529, fig. 4. Syntype workers, NEW GUINEA: Papua, Rawlinsongebirge (MNHU, Berlin) [examined].
Xiphomyrmex tricolor Donisthorpe, 1949 : 753. Holotype worker, NEW GUINEA: Maffin Bay, 10.vi.1944 (*E. S. Ross*) (CAS, San Francisco) [examined]. **Syn. n.**

WORKER. TL 3·4–4·4, HL 0·86–1·06, HW 0·74–0·92, CI 84–89, SL 0·60–0·78, SI 81–89, PW 0·54–0·64, AL 1·00–1·20 (15 measured).

Mandibles smooth, unsculptured except for scattered pits. Clypeus with a median notch or impression. Median portion of clypeus with three strong longitudinal carinae. Frontal carinae extending back almost to the occiput. Maximum diameter of eye *c.* 0·17–0·20, about 0·22–0·24 × HW. Propodeal spines in profile long, narrow and acute; metapleural lobes broadly triangular, acute and somewhat upcurved. Petiole node in profile with the anterior face distinctly shorter than the posterior so that the convex dorsal surface slopes upwards posteriorly and the posterodorsal angle is on a higher level than the rounded anterodorsal angle. Sculpture of dorsum of head between frontal carinae consisting of three longitudinal carinae which in most specimens run uninterruptedly from clypeus almost to occiput. In some the lateral pair of carinae are interrupted or broken and in most specimens other short carinae or rugulae are present upon the dorsum. Some anastomosis of the rugulae or carinae may occur occipitally, but reticulate sculpture is absent. Ground sculpture between the carinae or rugae is very faint and the surfaces are mostly shiny. Dorsal alitrunk rugose, predominantly longitudinally in some, but with pronotal or other reticulation in others. Petiole and postpetiole rugose, usually longitudinal on dorsum but reticulate on the sides, less commonly reticulate everywhere. Gaster unsculptured. Long, erect or suberect hairs present on all dorsal surfaces of head and body. Colour conspicuous, head and gaster blackish brown to black, alitrunk and all appendages yellow or very light yellow-brown. Some of the larger workers also show patches of yellowish colour around the occipital margins of the head.

Closely related to *pacificum*, *tricarinatum* is easily separated from that species by its distinct colour and reduced sculpture. It is one of three bicoloured black and yellow species of *Tetramorium* found on New Guinea. One of these, *diligens*, belongs to the *carinatum*-group and has 11 antennal segments and a spatulate sting appendage, the other, *bicolor*, is very closely related but much less strongly sculptured.

MATERIAL EXAMINED. NEW GUINEA: Maffin Bay (*E. S. Ross*); Kwa Riv., Laulaunung (*E. O. Wilson*); Ebabaang (*E. O. Wilson*), Tumnang (*E. O. Wilson*); Wamuki (*E. O. Wilson*); Nganduo (*E. O. Wilson*). NEW IRELAND: Kait Riv. (*J. L. Gressitt*).

Tetramorium validiusculum Emery

Tetramorium pacificum subsp. *validiusculum* Emery, 1897a : 585. Syntype workers, NEW GUINEA: Berlinhafen (*L. Biró*) (MHN, Geneva) [examined]. [Also described as new in Emery, 1897b : 568.]
Tetramorium validiusculum Emery; Wilson & Taylor, 1967 : 73. [Raised to species; implied in text.]

Tetramorium longicarinum Donisthorpe, 1941 : 57. Holotype and paratype workers, NEW GUINEA: Papua, Mafulu, 4000 ft, xii.1933 (*L. E. Cheesman*) and Japen I., Mt Eiori, 2000 ft, x.1938 (*L. E. Cheesman*) (BMNH) [examined]. **Syn. n.**

WORKER. TL 3·7–4·6, HL 0·86–1·16, HW 0·74–1·10, CI 84–94, SL 0·62–0·84, SI 76–87, PW 0·56–0·74, AL 1·02–1·30 (20 measured).

Mandibles unsculptured, smooth except for pits from which hairs arise. Anterior clypeal margin with a weakly developed median impression or notch. Median portion of clypeus with three main longitudinal carinae, in some large specimens the anterior half of the clypeus feebly transversely concave. Frontal carinae strongly developed, extending back almost to the occipital margin. Eyes with maximum diameter *c.* 0·18–0·23. Propodeal spines long, acute, usually narrow and sometimes slightly upcurved along their length. Metapleural lobes triangular, acute and feebly upcurved. Petiole node in profile shaped as in *pacificum* (see Fig. 15), with the anterior face shorter than the posterior so that the convex dorsal surface slopes upwards posteriorly and the posterodorsal angle is higher than the anterodorsal. The last cannot accurately be called an angle as in this species the anterior face joins the dorsum through a curve. Dorsum of head sculptured with a series of spaced longitudinal carinae or rugulae, some of which may be short or broken. Cross-meshes are either completely absent or a few cross-meshes or anastomoses may be present occipitally, but there is never a strongly developed rugoreticulum behind the level of the eyes as is found in most species of this group, nor do cross-meshes occur in front of the level of the posterior margins of the eyes. Ground sculpture faint and inconspicuous so that spaces between rugulae and carinae on head are shiny and mostly quite smooth. Dorsal alitrunk, petiole and postpetiole usually reticulate-rugose but this is commonly reduced in density and intensity. Gaster unsculptured, smooth and shining. All dorsal surfaces of head and alitrunk with numerous long, erect or suberect hairs. Colour uniform very dark brown to black.

This species is a sibling of *pacificum*, differentiated from it by the strongly reduced cephalic sculpture found in *validiusculum*. In some respects it resembles *cynicum* of the Philippines (see there), another sibling of *pacificum* whose range does not appear to overlap that of *validiusculum*, which is restricted to New Guinea and Queensland, particularly the Cape York Peninsula.

MATERIAL EXAMINED. NEW GUINEA: Huon Pen., L. Busu Riv. (*E. O. Wilson*); Saruwaged Ra (*E. O. Wilson*); Bubia (*E. O. Wilson*); Lae, Didiman Ck (*E. O. Wilson*); Bisianumu (*E. O. Wilson*); Wamuki (*E. O. Wilson*); Butala (*E. O. Wilson*); Brown Riv., Karema (*E. O. Wilson*); Korop (*J. L. Gressitt*). AUSTRALIA: Cape York, Lockerbie (*Darlingtons*); C.Y., Rocky River (*Darlingtons*), C.Y., McIlwraith Range (*Darlingtons*); Cooktown, Shipton's Flat (*Darlingtons*).

The *ornatum*-group

Antennae with 12 segments. Sting appendage dentiform or pennant-shaped. Clypeus with the anterior margin usually entire but in one species (*wagneri*) a notch is present. Frontal carinae in this group generally reduced in length or are weakly developed, or both, usually they end just behind the level of the eyes. In one species they are very short (*politum*), and in one they are strongly developed (*rigidum*), but in some the shortness of the true frontal carinae may be masked by the strong longitudinal cephalic sculpture. Propodeal spines are characteristically long or very long and are downcurved or sinuate along their length (not in *deceptum*). Petiole with a long, curved anterior peduncle and usually with a low node (Figs 23–30). Sculpture on the head is basically of dense longitudinal carinae or rugae, generally without cross-meshes, but in one species (*politum*) the sculpture is very reduced. All dorsal surfaces of the head and body have numerous hairs which are fine and of varying length, but the hind tibiae have hairs which are short or very short and are generally decumbent or appressed.

This group is based upon New Guinea and eight of the twelve species included are restricted to that island. One species is endemic in the Solomon Is (*salomo*), two occur only in Queensland (*australe*, *deceptum*), but the final species, *ornatum* itself, is distributed in the Bismark Archipelago and Queensland, as well as being present in New Guinea.

Tetramorium basum sp. n.
(Fig. 30)

HOLOTYPE WORKER. TL 3·2, HL 0·74, HW 0·66, CI 89, SL 0·56, SI 85, PW 0·48, AL 0·90.

Mandibles striate, anterior clypeal margin convex and entire. Frontal carinae extending back beyond the posterior margin of the eyes but then broken or interrupted, their place taken by the coarse longi-

tudinal sculpture which is as strongly developed as the frontal carinae and which extends back to the occipital margin. Maximum diameter of eye *c.* 0·14. Occipital margin of head broadly but shallowly concave in full-face view, the sides of the head only very feebly convex. Propodeal spines very long, narrow and acute, elevated and downcurved along their length. Metapleural lobes broad basally but quickly narrowing to an elongate acute point. Petiole in profile with a long, downcurved anterior peduncle, shape of the node as shown in Fig. 30. Clypeus with five main longitudinal carinae and with other shorter, weaker carinae present. Dorsum of head densely sculptured with regular coarse longitudinal carinae without cross-meshes of any sort, the spaces between the carinae filled with a dense and very conspicuous reticulate-puncturation. Dorsal alitrunk with a rugoreticulum, the meshes small and the spaces which they enclose with some puncturation which is much weaker than that seen on the head. Petiole with longitudinal rugae which are oblique and spaced out on the sides but more close-packed dorsally. Postpetiole and gaster unsculptured, smooth and shining. Fine hairs present on all dorsal surfaces of head and body. Dorsal (outer) surfaces of hind tibiae with short subdecumbent or decumbent hairs which are much shorter than the maximum tibial width. Colour reddish brown, the appendages yellow or yellow-brown. First gastral tergite with the basal third yellow, the remainder blackish brown.

PARATYPE WORKER. As holotype but slightly smaller, TL 2·9, HL 0·70, HW 0·64, CI 91, SL 0·52, SI 81, PW 0·46, AL 0·84.

Holotype worker, NEW GUINEA: Mongi Watershed, Huon Pen., Wamuki, 19–20.iv.1955, 800 m, no. 846 (*E. O. Wilson*) (MCZ, Cambridge).

Paratype. 1 worker with same data as holotype (BMNH).

In the *ornatum*-group two species are presently known in which the spaces between the carinate cephalic sculpture are filled with dense puncturation. *T. basum* is one of these, the other being *rigidum*. The two are separable as in *rigidum* there are a number of conspicuous cross-meshes between the longitudinal carinae of the head, absent in *basum*, and the gaster is uniformly coloured in *rigidum*, without the basal yellow area seen in *basum*.

Tetramorium centum sp. n.

HOLOTYPE WORKER. TL 3·5, HL 0·80, HW 0·74, CI 92, SL 0·64, SI 86, PW 0·52, AL 0·96.

Mandibles striate, anterior clypeal margin entire and with a narrow but quite conspicuous apron or flange anteriorly. Frontal carinae no more strongly developed than the rugose sculpture on the head, meandering and irregular, broken in places (more sharply developed in some of the paratypes). Eyes moderate, maximum diameter *c.* 0·16. Propodeal spines long, narrow and acute, more or less straight. Metapleural lobes elongate-triangular and acute. Petiole with a long, downcurved peduncle, the node in profile roughly rectangular in shape, the dorsum feebly but evenly convex and slightly longer than the height of the tergal portion of the node. Postpetiole more narrowly convex, dome-shaped in profile. Dorsum of head with numerous long, irregular or meandering longitudinal rugae with scattered cross-meshes posteriorly. Spaces between the rugae showing vestigial traces of superficial sculpture but for the most part smooth and shining. Dorsal alitrunk with a loose, open rugulation, the large spaces enclosed by the meshes smooth. Dorsum of petiole with an unsculptured median longitudinal strip, the sides of the node sparsely and obliquely rugose. Postpetiole and gaster unsculptured. All dorsal surfaces of head and body with numerous fine hairs, those on the dorsal (outer) surfaces of the hind tibiae suberect to subdecumbent and much shorter than the maximum tibial width. Colour uniform dark brown, the appendages yellow-brown.

PARATYPE WORKERS. TL 3·3–3·5, HL 0·76–0·82, HW 0·70–0·74, CI 90–92, SL 0·60–0·64, SI 81–86, PW 0·50–0·54, AL 0·92–0·98. Maximum diameter of eye 0·14–0·16 (7 measured). Mostly as holotype but in some the frontal carinae more strongly developed, running almost to the occipital margin. Colour in some a lighter brown than seen in the holotype.

Holotype worker, NEW GUINEA: Mongi Watershed, Huon Pen., Joangeng, 7–8.iv.1955, 1500 m, no. 746 (*E. O. Wilson*) (MCZ, Cambridge).

Paratypes. 7 workers and 2 alate females, same data as holotype but no. 751 (MCZ, Cambridge; BMNH).

Tetramorium etiolatum sp. n.
(Fig. 29)

HOLOTYPE WORKER. TL 3·4, HL 0·76, HW 0·66, CI 87, SL 0·66, SI 100, PW 0·52, AL 0·96.

Mandibles striate. Anterior clypeal margin convex, entire, with a narrow anterior flange or apron. Frontal carinae extending back beyond the level of the posterior margins of the eyes but weak, no more strongly developed than the other sculpture on the dorsum of the head. Behind the level of the eyes the frontal carinae petering out, their place taken by other constituents of the sculpture or, in some of the type-series, interrupted or broken in places. Antennal scrobes scarcely noticeable, the antennal scapes relatively long (SI in entire type-series 96 or more). Maximum diameter of eye *c.* 0·14. Propodeal spines very long, narrow and acute, distinctly downcurved along their length. Metapleural lobes triangular. Petiole in profile with a long, curved anterior peduncle and a long, low node, the dorsal length of the node greater than the height of the tergal portion, the dorsum evenly but shallowly convex. Posteriorly the dorsum rounds evenly into the posterior face, the two not separated by an angle. Postpetiole in profile dome-shaped. Clypeus with five main longitudinal carinae and also with traces of other incomplete and more feebly developed carinae. Dorsum of head strongly sculptured with longitudinal carinate rugae, most of which are feebly sinuate or meandering. Cross-meshes are not developed and the ground sculpture between the rugae consists of very shallow superficial punctures which are inconspicuous. Dorsal alitrunk weakly reticulate-rugose, the reticulum broken down or disorganized in places. Petiole with scattered vestiges of rugose sculpture, postpetiole and gaster unsculptured. All dorsal surfaces of head and body with numerous fine soft hairs, those on the dorsal (outer) surface of the hind tibiae short and curved. Colour uniform blackish brown, the appendages lighter, mid-brown.

PARATYPE WORKERS. TL 3·2–3·7, HL 0·70–0·80, HW 0·62–0·68, CI 84–89, SL 0·60–0·68, SI 96–101, PW 0·48–0·54, AL 0·90–1·00. Maximum diameter of eye *c.* 0·14–0·16 (16 measured). As holotype but with variation in development of frontal carinae noted above. A few specimens have the legs a paler brown than in the holotype.

Holotype worker, NEW GUINEA: Mongi Watershed, Huon Pen., Gemeheng, 11–13.iv.1955, 1300 m, no. 785 (*E. O. Wilson*) (MCZ, Cambridge).

Paratypes. NEW GUINEA: 9 workers and 2 females (1 alate) with same data as holotype; 2 workers, 2 females (alate) and 2 males, Mongi Watershed, Huon Pen., Ebabaang, 16–18.iv.1955, 1300–1400 m, no. 817 (*E. O. Wilson*); 5 workers and 1 female (dealate) with same data as last but no. 838 (*E. O. Wilson*); 2 workers, Mongi Watershed, Huon Pen., Tumnang, 14–15.iv.1955, 1500 m, no. 798 (*E. O. Wilson*) (MCZ, Cambridge; BMNH).

The long, narrow, downcurved propodeal spines characteristic of most species of the *ornatum*-group are very well developed in *etiolatum*, but this species is quickly differentiated from most of its relatives by the possession of relatively long antennal scapes, which in *etiolatum* have SI range 96–101 compared with the usual range of about 80–90 in most of the group. The only species with SI outside this range is *politum* (SI 105) but here the head is mostly unsculptured whereas in *etiolatum* the head is sculptured everywhere.

Tetramorium navum sp. n.

(Fig. 27)

HOLOTYPE WORKER. TL 3·3, HL 0·78, HW 0·74, CI 95, SL 0·58, SI 78, PW 0·52, AL 0·92.

Mandibles striate. Anterior clypeal margin extremely feebly concave (straight to feebly convex in paratype series). Frontal carinae long and strong, extending back almost to the occipital corners. Maximum diameter of eye *c.* 0·16. Occipital margin of head broadly and shallowly concave in full-face view, sides of head behind eyes feebly convex. Propodeal spines stout, long and acute, somewhat elevated but slightly downcurved along their length. Metapleural lobes elongate-triangular and acute. Petiole node in profile with a downcurved anterior peduncle. Dorsal surface of petiole node curving evenly into posterior face, the two not separated by an angle. Dorsal length of node in profile about equal to the height of the tergal portion of the node. Postpetiole in profile evenly convex, dome-like. Median portion of clypeus with five longitudinal carinae, the outermost very close to the concave edge of the clypeus just in front of the frontal carinal lobe. (In a few paratypes only the median and outer carinae are strongly developed, the inner pair being feeble.) Dorsum of head sculptured with strong, widely spaced longitudinal carinae, about seven in number between the frontal carinae at the level of the eyes. A few very weak cross-meshes present, much weaker than the carinae, and the ground sculpture between the carinae exceedingly feeble. Dorsal alitrunk with a loose rugoreticulum. Petiole sparsely and weakly rugulose, the dorsal postpetiole and gaster unsculptured but the sides of the postpetiole retaining vestigial sculpture basally. Fine erect or suberect hairs present upon all dorsal surfaces of head and body but hairs on scapes and dorsal (outer)

surfaces of hind tibiae very short, decumbent or appressed. Colour very dark brown, the appendages lighter.

PARATYPE WORKERS. TL 3·0–3·5, HL 0·74–0·84, HW 0·70–0·80, CI 92–95, SL 0·56–0·64, SI 76–81, PW 0·48–0·56, AL 0·84–0·98. Maximum diameter of eye 0·15–0·18 (10 measured). As holotype, with the variation noted above and also some paratypes with propodeal spines feebly sinuate (Fig. 27) as the downcurvature tends to flatten out or even be very slightly upcurved towards the apices.

Holotype worker, NEW GUINEA: Nadzab, 20–22.v.1955, no. 1101, dry evgr. for. (*E. O. Wilson*) (MCZ, Cambridge).

Paratypes. 2 workers with same data as holotype; 2 workers with same data but no. 1086; 6 workers with same data but no. 1093 (MCZ, Cambridge; BMNH).

Among the species of the *ornatum*-group in which the propodeal spines are downcurved, *navum* is distinguished by having strongly developed frontal carinae and sparse but strong carinate sculpture on the head. In other species showing very strong longitudinal cephalic sculpture the components are much more densely packed, with 10 or more between the frontal carinae at the level of the eyes, or the spaces between the longitudinal components are packed with coarse reticulate-punctate ground sculpture.

Tetramorium ornatum Emery

Tetramorium ornatum Emery, 1897a : 585, pl. 15, fig. 27. Syntype workers, NEW GUINEA: Berlinhafen (*L. Biró*) (MHN, Geneva) [examined].

Tetramorium ornatum var. *obscurius* Forel, 1901 : 11. Syntype workers, BISMARCK ARCHIPELAGO: Ralum, Lowon (*F. Dahl*) (MNHU, Berlin) [examined]. **Syn. n.**

WORKER. TL 3·0–3·8, HL 0·70–0·92, HW 0·60–0·84, CI 84–91, SL 0·50–0·68, SI 80–87, PW 0·46–0·62, AL 0·86–1·14 (46 measured).

Mandibles striate, anterior clypeal margin convex and entire. Frontal carinae feeble, usually no more strongly developed than the longitudinal sculpture of the head, but extending back beyond the level of the eyes, sometimes almost reaching the occipital margin but here virtually indistinguishable from the other sculpture. Antennal scrobes present but exceedingly feeble. Maximum diameter of eye *c.* 0·12–0·16. Propodeal spines usually weakly downcurved along their length but sometimes almost straight or very weakly sinuate, variation being present in single nest-series. Metapleural lobes elongate-triangular and acute. Petiole in profile with a long peduncle and a long, low node, the dorsal length of which is about equal to or slightly greater than the height of the tergal portion. Clypeus with five distinct longitudinal carinae of about equal strength, sometimes with another intercalary pair present which are usually weaker or incomplete. Dorsum of head strongly sculptured with regular, more or less parallel longitudinal rugae or carinae, without cross-meshes. These rugae are closely packed, with usually 12–15 between the frontal carinae at the level of the eyes (a few specimens are known with 10–11). Dorsal alitrunk with a coarse rugoreticulum which extends down the sides of the pronotum. Sides of nodes of petiole and postpetiole rugose but on the postpetiole dorsum this is usually weaker. Gaster unsculptured. All dorsal surfaces of head and body with numerous fine hairs, those on the dorsal (outer) surface of the hind tibiae short and curved. Colour varying from reddish brown to blackish brown.

This is the most widespread species of the group, occurring in the Bismarck Archipelago and in Queensland (where a closely related species, *australe*, is also present) as well as being relatively common in parts of New Guinea. The closest relative of *ornatum* in New Guinea is the somewhat larger *sculptatum*, in which the frontal carinae are even more reduced and in which the antennal scrobes are completely lacking.

MATERIAL EXAMINED. NEW GUINEA: Finschafen (*E. S. Ross*); Maffin Bay (*E. S. Ross*); Boingbongen (*E. O. Wilson*); Tumnang (*E. O. Wilson*); Yunzain to Joangeng (*E. O. Wilson*); Zinzingu (*E. O. Wilson*); Nganduo (*E. O. Wilson*); Lae, Didiman Ck (*E. O. Wilson*); L. Busu Riv., Huon Pen. (*E. O. Wilson*); W. Highlands, Baiyer R. (*S. Peck*); Wau (*S. Peck*). AUSTRALIA: Cape York, v. Tozer Gap (*Darlingtons*); C.Y., Rocky River (*Darlingtons*).

Tetramorium politum Emery
(Fig. 23)

Tetramorium politum Emery, 1897b : 568. Holotype worker, NEW GUINEA: Moraka (*L. Loria*) (probably in MCSN, Genoa).

WORKER. TL 3·8, HL 0·88, HW 0·74, CI 84, SL 0·78, SI 105, PW 0·58, AL 1·08.

Mandibles feebly sculptured. Anterior clypeal margin entire, evenly convex. Frontal carinae short, extending back only to the level of the eyes. Occipital margin of head in full-face view rounded and evenly convex. Maximum diameter of eye *c.* 0·16. Antennal scapes long, SI > 100, the scapes surpassing the occipital margin when laid straight back along the head. Propodeal spines long, narrow and acute, slightly downcurved along their length. Metapleural lobes rounded, blunt. Petiole in profile with a long, curved anterior peduncle and a node which in profile is about as long as high, the dorsum feebly convex. Postpetiole in profile as high as petiole but narrower and more strongly convex dorsally (Fig. 23). Sculpture sparse, the integument mostly smooth. Clypeus with a strong median carina and with vestiges of others laterally. Head with median carina running from the clypeus to the level of the posterior margins of the eyes and with faint traces of other sculpture on each side of the carina, but otherwise the head unsculptured dorsally. Dorsal surfaces of alitrunk, petiole and postpetiole mostly smooth but with scattered faint rugulae present in places; sides of these areas more strongly sculptured than the dorsum but still only weakly marked. Gaster unsculptured. Very fine erect or suberect hairs present on all dorsal surfaces, those projecting from the dorsal (outer) surface of the hind tibiae short and curved, much shorter than the maximum tibial width. Colour uniform blackish brown, the legs and antennae lighter.

T. politum is the most specialized member of the *ornatum*-group in New Guinea and in its elongate scapes, rounded head and reduced sculpture it parallels the developments seen in *bicolor* (*bicarinatum*-group) and *diligens* (*carinatum*-group). However, the elongate petiole peduncle and downcurved propodeal spines characteristic of most species of the *ornatum*-group are retained. The tendency to shorten or reduce the frontal carinae in this group reaches its strongest expression in *politum* and the effect is enhanced by the extreme reduction in sculpture everywhere on the head. The frontal carinae are really no more strongly developed in such species as *sculptatum* but the appearance is not so striking here as the entire head is covered with close-packed longitudinal sculpture.

MATERIAL EXAMINED. NEW GUINEA: Japen I., Central Range (*L. E. Cheesman*).

Tetramorium rigidum **sp. n.**
(Fig. 28)

HOLOTYPE WORKER. TL 2·9, HL 0·70, HW 0·64, CI 91, SL 0·52, SI 81, PW 0·50, AL 0·86.

Mandibles striate; anterior clypeal margin entire. Frontal carinae long, extending back almost to the occipital margin. Antennal scrobes present but weak, consisting of a shallowly impressed area which extends back beyond the level of the eye in profile and is less strongly sculptured than remainder of head. Maximum diameter of eye *c.* 0·14. With the alitrunk in profile the propodeal dorsum strongly sloping downwards to the bases of the spines. Propodeal spines long, tapering and acute, feebly downcurved along their length. Metapleural lobes elongate-triangular and acute. Petiole in profile with a long, downcurved peduncle and a relatively high, angular node, the height of the tergal portion of the node greater than its dorsal length. Clypeus with five main longitudinal carinae and in places with traces of other, weaker rugulae between them. Dorsum of head densely longitudinally rugose with numerous conspicuous cross-meshes behind the level of the eyes. Spaces between the rugae packed with a very conspicuous reticulate-puncturation. Area of antennal scrobe reticulate-punctate with only faint traces of rugulae. Dorsal alitrunk reticulate-rugose, the spaces densely reticulate-punctate. Petiole similarly but much less strongly sculptured, both components faint. Sides of postpetiole even more faintly sculptured, the dorsum smooth or with vestiges of sculpture which are almost completely effaced. Gaster unsculptured. All dorsal surfaces of head and body with fine erect or suberect hairs. Dorsal (outer) surface of hind tibiae with very short hairs which are decumbent or appressed. Colour uniform very dark reddish brown, the appendages somewhat lighter.

PARATYPE WORKER. TL 2·8–3·0, HL 0·68–0·76, HW 0·62–0·70, CI 88–92, SL 0·48–0·54, SI 77–81, PW 0·48–0·54, AL 0·84–0·92. Maximum diameter of eye *c.* 0·13–0·15 (15 measured). As holotype but some paratypes teneral, without full adult coloration.

Holotype worker, NEW GUINEA: Papua, Karema, Brown R., 8–11.iii.1955, no. 564, lowl. rainfor. (*E. O. Wilson*) (MCZ, Cambridge).

Paratypes. 11 workers with same data as holotype; 3 workers with same data as holotype but no. 563; 2 workers as holotype but no. 546 (MCZ, Cambridge; BMNH).

The very distinctive reticulate-punctate sculpture which fills all the spaces between the rugose

sculpture is characteristic of this species and of *basum* in the *ornatum*-group. However, *basum* lacks cross-meshes in the cephalic dorsal sculpture, which are conspicuous in *rigidum*, and the gaster is basally yellow in *basum* but unicoloured in *rigidum*.

Tetramorium salomo Mann
(Fig. 25)

Tetramorium salomo Mann, 1919 : 344. Holotype worker, SOLOMON Is: Malaita I., Auki, 1916 (*W. M. Mann*) (USNM, Washington) [examined].

WORKER. TL 3·2–3·5, HL 0·74–0·78, HW 0·70–0·76, CI 95–97, SL 0·60–0·64, SI 84–88, PW 0·54–0·58, AL 0·88–0·94 (3 measured).

Mandibles striate. Anterior clypeal margin entire, with a narrow flange or apron which projects over the basal margins of the mandibles. Frontal carinae weak, diverging strongly to the level of the posterior margins of the eyes then fading out or becoming indistinguishable from the surrounding sculpture. Antennal scrobes absent. Maximum diameter of eye *c*. 0·16–0·18. Outline of dorsal alitrunk in profile evenly convex. Propodeal spines very long, narrow and acute, feebly downcurved along their length. Metapleural lobes elongate-triangular, acute apically. Petiole with a long, downcurved anterior peduncle and a long, low node, the dorsal length of which is greater than the height of the tergal portion in profile. Dorsum of head with numerous longitudinal rugae which are irregular, either sinuate or meandering but without cross-meshes, although a few weak anastomoses may be present very close to the occipital margin. Spaces between rugae mostly unsculptured and shining but here and there a few very faint punctures may be seen. Dorsal alitrunk predominantly longitudinally rugose but with some sparse reticulation present, especially on the anterior pronotum. All surfaces of petiole and postpetiole covered with a very close, fine rugoreticulum, gaster unsculptured. All dorsal surfaces of head and body with abundant fine short hairs. Dorsal (outer) surfaces of hind tibiae with a dense coat of very short, curved hairs which are directed towards the apex of the segment. Colour uniform yellow to light yellow-brown.

This is the only species of the *ornatum*-group which is not known to occur in New Guinea, and is one of the two species of the group which are found in localities other than New Guinea (the other is *ornatum* which occurs in the Solomon Islands and in Queensland). Its size, colouring, strongly sculptured pedicel segments and very long, weakly downcurved spines should quickly distinguish *salomo* from any other *Tetramorium* species in the Solomon Islands.

MATERIAL EXAMINED. SOLOMON IS: Guadalcanal (*P. Greenslade*).

Tetramorium sculptatum sp. n.
(Fig. 26)

HOLOTYPE WORKER. TL 4·1, HL 1·00, HW 0·90, CI 90, SL 0·76, SI 84, PW 0·68, AL 1·20.

Mandibles striate; anterior clypeal margin entire and weakly convex. Frontal carinae short, ending at the level of the posterior margins of the eyes, not more strongly developed than the surrounding longitudinal sculpture and quite inconspicuous. Antennal scrobes absent. Maximum diameter of eyes *c*. 0·18. Propodeal spines long and acute, feebly downcurved along their length. On the holotype the right hand spine more strongly curved than the left; in some paratypes the spines are very weakly sinuate. Metapleural lobes elongate and acute. Petiole in profile with a long peduncle; node shape showing considerable variation in type-series due to the variable obliteration of the anterodorsal angle. The limits of this variation as shown in the type-series are given in Fig. 26. Clypeus with seven carinae in holotype (in paratype series varying from 5–7, one pair of carinae being variably developed). Dorsum of head very coarsely, regularly and densely longitudinally carinate-rugose or appearing sulcate, with about 12 longitudinal components between the frontal carinae at the level of the eyes. Behind the level of the eyes the sculpture diverges strongly and runs off the dorsum of the head and down the sides, intersecting the lateral outline of the head (full-face view) in the posterior two-thirds or so of the sides behind the eyes. Dorsal alitrunk coarsely reticulate-rugose or reticulate-foveolate, the raised portions rounded and the reticulum itself very irregular. In some paratypes this sculpture is reduced and in one or two is almost effaced so that the surface is almost smooth but with irregular rounded elongate prominences. Petiole and postpetiole rugose, the dorsum of the postpetiole less strongly so than the sides. Gaster unsculptured. All dorsal surfaces of head and body with numerous fine hairs, those on the dorsal (outer) surface of the hind tibiae very short, much less than the maximum tibial width. Colour very dark blackish brown to black, the appendages somewhat lighter.

PARATYPE WORKERS. As holotype and with the variation mentioned above, but also in many the frontal carinae confluent with one component of the longitudinal sculpture on the dorsum of the head. Size range TL 3·8–4·4, HL 0·90–1·06, HW 0·84–0·96, CI 88–93, SL 0·70–0·82, SI 80–87, PW 0·62–0·74, AL 1·10–1·34. Maximum diameter of eye 0·14–0·18 (21 measured).

Holotype worker, NEW GUINEA: Papua, Wau, 1.vii.1974, 4000 ft, for. litter (*S. Peck*) (MCZ, Cambridge).

Paratypes. NEW GUINEA: 8 workers with same data as holotype; 13 workers, Papua, Mt Hagen area, 5.vii.1974, *c.* 2000 m, no. B-280 (*S. Peck*) (MCZ, Cambridge; BMNH; NM, Basle; MHN, Geneva).

The very distinctive cephalic sculpture and lack of antennal scrobes distinguish this species from others of the group.

Tetramorium wagneri Viehmeyer
(Fig. 24)

Tetramorium wagneri Viehmeyer, 1914 : 528, fig. 3. Holotype worker, NEW GUINEA: Papua, Wareo (MNHU, Berlin) [examined].

WORKER. TL 3·8–4·8, HL 0·90–1·06, HW 0·78–0·96, CI 86–92, SL 0·70–0·86, SI 86–92, PW 0·58–0·70, AL 1·06–1·28 (25 measured).

Mandibles coarsely striate. Clypeus with a median notch or impression of variable size, small in some individuals. Maximum diameter of eye *c.* 0·18–0·20. Frontal carinae stretching back beyond the level of the posterior margins of the eyes but behind this commonly broken or interrupted, their place taken by the very strong longitudinal carinate rugae of the head. In some specimens the carinae continue unbroken to close to the occipital margin. Occipital margin of head conspicuously concave in dorsal view. Propodeal spines very long, narrow, acute and slightly downcurved along their length. Metapleural lobes short, acute and triangular. Peduncle of petiole very long and downcurved, the node in profile high and quite narrow, the tergal portion of the node higher than the dorsal length. Clypeus with five or more longitudinal carinae of approximately equal strength, the dorsum of the head very strongly and coarsely sculptured with regular, sharp longitudinal carinae of which there are about 10 (number varies between individuals) between the frontal carinae at the level of the eyes. Cross-meshes between these carinae are completely absent. Ground sculpture between the carinae consists of faint superficial punctulation, which in many is almost effaced. Dorsal alitrunk reticulate-rugose. Sides of petiole and postpetiole with sparse longitudinal rugae but these are much fainter on the latter than on the former, vestigial in some. Dorsum of postpetiole unsculptured or at most with faint superficial shagreening or punctures. Gaster unsculptured. Fine hairs present on all dorsal surfaces of head and body but those on the dorsal (outer) surface of the hind tibiae short, much shorter than the maximum tibial width, and subdecumbent or decumbent. Colour dark reddish brown to blackish brown, the appendages lighter.

This is the only known species of the *ornatum*-group which has a notched or impressed anterior clypeal margin and because of this it runs out in the key close to the members of *bicarinatum*-group where such a notch is universally present. However, the sculpture, form of the propodeal spines and petiole identify *wagneri* as a member of the *ornatum*-group.

MATERIAL EXAMINED. NEW GUINEA: Madang Distr., Finisterre Mts (*M. E. Bacchus*); Saruwaged Ra, upper Bunbok Valley (*E. O. Wilson*); Nganduo (*E. O. Wilson*); Boana, Bunbok Valley (*E. O. Wilson*).

The *inglebyi*-group

Antennae with 12 segments. Appendage of sting triangular or dentiform. Frontal carinae absent or very short indeed, not reaching the level of the anterior margins of the eyes. Eyes small (*elisabethae*, *inglebyi*) or minute, reduced to a single facet in *myops*. Antennal scrobes absent. Base of first gastral tergite strongly concave in dorsal view, the anterolateral angles of the sclerite angular, produced as a short tubercle or tooth on each side of the posterolateral corners of the postpetiole (Fig. 35).

This small group of three pale-coloured species, apparently restricted to India, is easily characterized by the features given above. The strange modification of the base of the first gastral tergite is also seen in the *mixtum*-group, but here the frontal carinae reach back beyond the eyes, and the eyes themselves are not reduced as in the *inglebyi*-group.

Tetramorium elisabethae Forel

Tetramorium elisabethae Forel, 1904 : 20. Syntype workers, INDIA: Sind Valley, Kashmir (*Wroughton*) (MHN, Geneva; MCZ, Cambridge; BMNH) [examined].

WORKER. TL 2·9–3·1, HL 0·68–0·74, HW 0·60–0·64, CI 86–90, SL 0·50–0·52, SI 80–83, PW 0·44–0·50, AL 0·78–0·84 (5 measured).

Mandibles feebly striate; true anterior clypeal margin entire but the narrow lamellate apron or flange indented medially, the intensity of the indentation variable. Frontal carinae very short, ending before or at the level of the anterior margins of the eyes. Antennal scrobes absent. Eyes very small, with only about seven facets, the maximum diameter *c.* 0·06. Propodeal spines short and triangular, dentiform and feebly upcurved. Metapleural lobes broad and rounded. Petiole node relatively high in profile, the height of the tergal portion greater than the dorsal length. In dorsal view both nodes distinctly broader than long, rounded and without angles. Base of first gastral tergite strongly concave and accommodating the posterior margin of the postpetiole. On each side of this the anterolateral portions of the tergite are angular and project forwards. Dorsum of head with very fine but quite dense, predominantly longitudinal rugulation, and with faint reticulation on the sides above the eyes. Dorsal alitrunk somewhat more conspicuously rugulose than the head, feebly reticulate in places. Petiole, postpetiole and gaster unsculptured. All dorsal surfaces of head and body with quite dense short, fine hairs, the majority of which are suberect to subdecumbent. On the scapes and hind tibiae the hairs are shorter and subdecumbent to decumbent. Colour uniform pale yellow.

T. elisabethae does not have any known close relatives, but the reduced eyes, short frontal carinae and the specialized shape of the gaster seem to indicate relationship with *inglebyi* and *myops*, although in other aspects such as the short propodeal spines and broad node its affinities lie in the direction of the *caespitum*-group.

Tetramorium inglebyi Forel
(Fig. 35)

Tetramorium inglebyi Forel, 1902a : 233. Holotype worker, INDIA: Travancore (*Ingleby*) (MHN, Geneva) [examined].

WORKER. TL 2·8, HL 0·74, HW 0·64, CI 86, SL 0·46, SI 72, PW 0·46, AL 0·76.

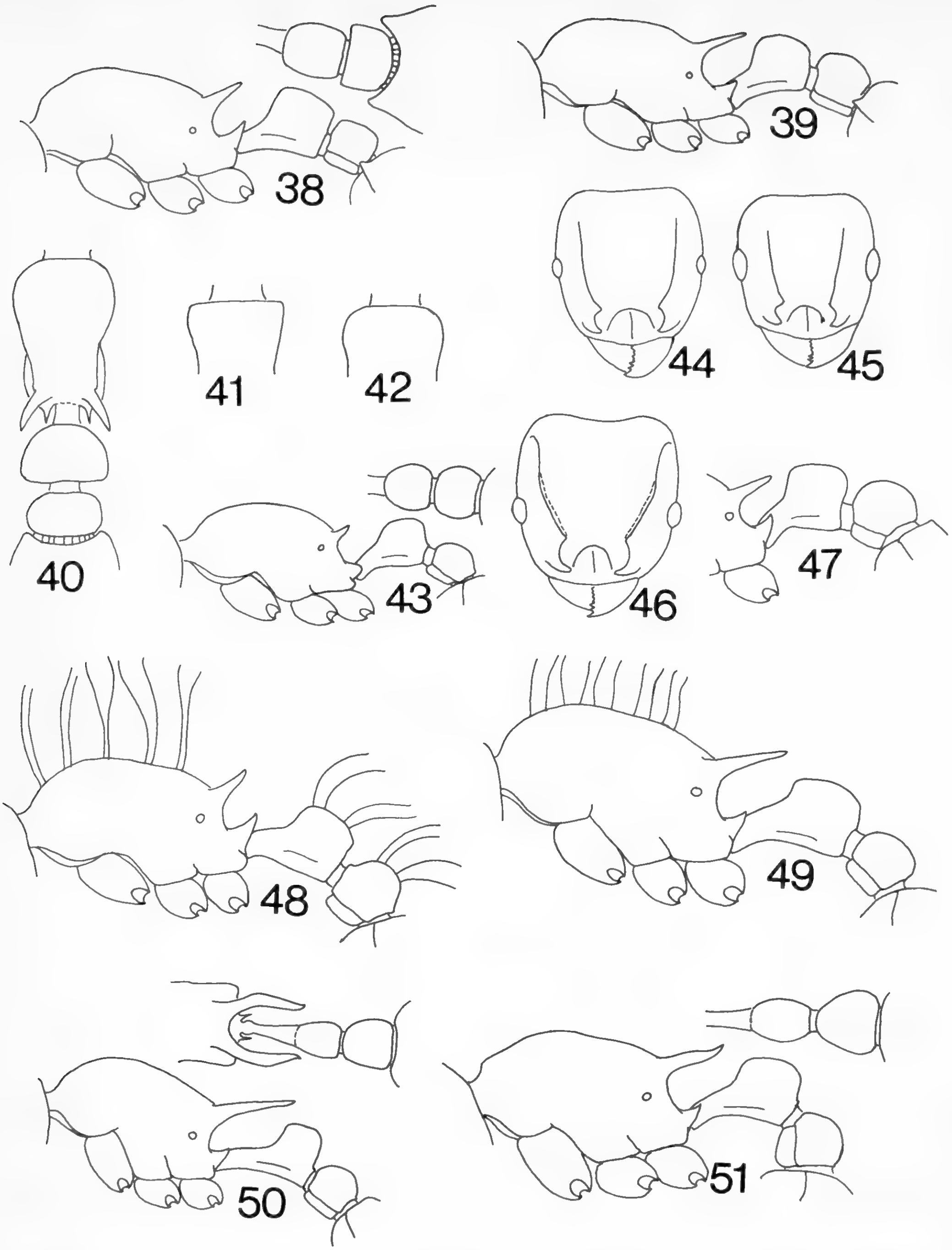
Clypeus very strongly downcurved in its apical half so that the true median anterior border cannot be seen in full-face view. Frontal carinae very short, not extending to level of eyes, terminating just behind the expanded lobes over the antennal insertions. Antennal scrobes absent. Eyes small, maximum diameter *c.* 0·10 or about 0·16 × HW. Propodeal spines short and stout, abruptly upcurved at the extreme apices. Metapleural lobes broadly triangular and acute, feebly upcurved. Petiole node in dorsal view approximately as long as broad, postpetiole subglobular, slightly broader than long. First gastral tergite in dorsal view with the anterolateral corners rounded and extended forwards to surround the articulation with the postpetiole, the margin of the tergite between the corners strongly concave. Dorsum of head with fine, predominantly longitudinal and somewhat uneven rugulation which grades into a reticulum posteriorly and on the sides. Dorsal alitrunk with sparse rugosity, the mesonotum predominantly unsculptured. Petiole and postpetiole dorsally mostly unsculptured, with faint rugulation towards the sides; gaster unsculptured. All dorsal surfaces of head and body with numerous fine erect hairs. Colour uniform yellow-brown.

The closest relative of *inglebyi* is *myops*, also from India, but in this latter species the eyes are reduced to a single facet and the clypeus does not show the abrupt curvature which characterizes *inglebyi*. Other species in which the frontal carinae are very short, namely *elisabethae*, *fergusoni*, *nursei* and *politum*, may be separated by the characters given in the key.

Tetramorium myops sp. n.
(Figs 36, 37)

HOLOTYPE WORKER. TL 2·8, HL 0·68, HW 0·62, CI 91, SL 0·48, SI 77, PW 0·44, AL 0·74.

Mandibles striate; anterior clypeal margin impressed medially. Frontal carinae very short, ending in front of the level of the eyes. Eyes themselves minute, consisting of only a single facet, not easily visible in full-face view. Propodeal spines stout, moderately long, slightly upcurved along their length. Metapleural lobes long, triangular and acute, roughly three-quarters as long as the propodeal spines. Peduncle



Figs 38–51. *Tetramorium* workers. 38, 39. Alitrunk and pedicel of (38) *mixtum*, (39) *rugigaster*. 40. Dorsal alitrunk and pedicel of *transversarium*. 41, 42. Pronotal angle shape in (41) *scabrosum*, (42) *pulchellum*. 43. Alitrunk and pedicel of *pulchellum*. 44–46. Heads of (44) *curtulum*, (45) *kraepelini*, (46) *chapmani*. 47. Propodeum and pedicel of *chapmani*. 48–51. Alitrunk and pedicel of (48) *flagellatum*, (49) *ciliatum*, (50) *curvispinosum*, (51) *zypidum*. Sculpture and pilosity omitted except in 48, 49 where only part of pilosity is shown.

of petiole with a large rounded, convex lamella ventrally, the tergal portion of the node higher than the dorsal length in profile. Base of first gastral tergite strongly concave medially behind the post-petiole, the anterolateral portions of the tergite produced anteriorly, forming a short tooth to either side of the posterior margin of the post-petiole. Dorsum of head with spaced-out, quite distinctive longitudinal rugulae, the dorsal alitrunk similarly sculptured but with some reticulation anteriorly. Petiole with some rugulation on sides and dorsum but post-petiole dorsum mostly smooth. Base of first gastral tergite with vestiges of superficial sculpture, very difficult to see. Dorsal surfaces of head and body with numerous erect or suberect hairs, but those on the scapes and tibiae short and decumbent or subdecumbent. Colour yellowish brown.

PARATYPE WORKERS. As holotype but with range of dimensions: TL 2·6–2·8, HL 0·66–0·68, HW 0·58–0·62, CI 86–91, SL 0·48–0·50, SI 77–83, PW 0·40–0·44, AL 0·70–0·74 (3 measured).

Holotype worker, INDIA: M.P. 11 mi. SW. Dhamtari, 340 m, 31.i.1962 (*E. S. Ross & D. Cavagnaro*) (CAS, San Francisco).

Paratypes. 3 workers with same data as holotype (CAS, San Francisco; BMNH; MCZ, Cambridge).

The minute eyes of *myops* make this species immediately recognizable. In fact, the eyes here are the smallest known for any species outside of the Ethiopian region where at least one species with reduced eyes is known. The affinities of *myops* lie with *inglebyi*, but in this latter species the eyes are larger and the anterior portion of the median clypeus is abruptly downcurved.

The *mixtum*-group

Antennae with 12 segments. Sting appendage triangular or dentiform. Frontal carinae reaching back beyond the level of the eyes but only weakly defined in some species. Eyes of moderate size. Base of first gastral tergite concave and the anterodorsal angles of the sclerite projecting as a pair of blunt teeth or horns on each side of the posterolateral postpetiolar corners (Fig. 38).

A small group of Oriental region species with one in Sri Lanka, two in India and one in Taiwan.

Tetramorium amium Forel **stat. n.**

Tetramorium mixtum st. *amia* Forel, 1912 : 53. Syntype workers, TAIWAN: Pilam (*H. Sauter*) (types not found, presumed lost).

In the description of this form Forel implies that it is similar to *mixtum* but smaller (TL 2·3–2·4) and with the clypeus more strongly carinate. The antennal scrobes are more strongly developed, with much finer sculpture, the limits of the scrobe delimited by a margin posteriorly and laterally which may be weak but is distinct. The eyes situated almost at the midlength of the sides of the head, further back than in *mixtum* where they are in front of the midlength. Petiole node not longer than broad in dorsal view. Propodeal spines narrower and less divergent than in *mixtum*, the basal border of the first gastral tergite less concave.

Forel states that *amium* may be a different species from *mixtum*, and on the strength of the characters above, extracted from the original description, I am inclined to agree with him.

Tetramorium mixtum Forel
(Fig. 38)

Tetramorium mixtum Forel, 1902a : 236. Syntype workers, INDIA: Coonoor (*Wroughton*), and Utakamand (*Wroughton*) (MHN, Geneva; MCZ, Cambridge) [examined].

WORKER. TL 3·1–3·5, HL 0·76–0·88, HW 0·72–0·86, CI 92–97, SL 0·50–0·56, SI 65–72, PW 0·48–0·56, AL 0·86–0·96 (12 measured).

Mandibles striate; anterior clypeal margin with a feeble median impression, virtually absent in some specimens. Frontal carinae weak, no more strongly developed than the remaining cephalic sculpture. Antennal scrobes very poorly developed, almost absent, their boundary not delimited posteriorly or ventrally. Eyes situated in front of middle of sides of head, their maximum diameter *c.* 0·14–0·16. Propodeal spines stout and acute, the metapleural lobes elongate-triangular and acute. Petiole in profile blocky and massive, shape as in Fig. 38. Postpetiole in profile almost flat dorsally. In dorsal view the petiole

node is usually slightly longer than broad but about as long as broad in some individuals. Base of first gastral tergite very concave behind the postpetiole, the anterolateral corners prominent and projecting forward as a pair of blunt teeth or horns which go round the sides of the posterior portion of the postpetiole (Fig. 38). Dorsum of head longitudinally rugulose, with some reticulation posteriorly. Dorsal alitrunk finely reticulate-rugulose and some trace of rugulose sculpture is also present on the petiole dorsum. Postpetiole dorsum with superficial punctulation. Gaster usually smooth and shining but in some specimens there are traces of faint shagreening close to the basal margin of the first tergite. Erect or suberect fine hairs present on all dorsal surfaces of head and body, but on the scapes and hind tibiae all the hairs are short and subdecumbent to decumbent. On the hind tibiae the longest hairs are less than half the maximum width of the tibia. Colour uniform medium to dark brown, the appendages lighter.

The modification of the base of the gaster seen in this species and its relatives also occurs in *inglebyi* and *myops*, but in these last-named species the frontal carinae are not developed. Amongst the close relatives of *mixtum*, both *rugigaster* and *transversarium* have the gaster distinctly sculptured, and *amium* has the antennal scrobes delimited by a margin posteriorly and ventrally, whereas in *mixtum* the gaster is at most exceedingly feebly sculptured and the limits of the scrobes are not defined. Finally, *rugigaster* and *transversarium* have long, erect hairs on the hind tibiae, absent in *mixtum* (presumably absent in *amium* also).

MATERIAL EXAMINED. INDIA: no loc. (ex coll. Bingham); Kerala State, W. Ghats, Silent Valley Reserve (*A. B. Soans & W. L. Brown*); Peria Reserve (*A. B. Soans & W. L. Brown*); Madras State (*A. B. Soans & W. L. Brown*).

Tetramorium rugigaster sp. n.
(Fig. 39)

HOLOTYPE WORKER. TL 3·4, HL 0·78, HW 0·76, CI 97, SL 0·52, SI 68, PW 0·56, AL 0·92.

Mandibles striate; anterior clypeal margin entire. Frontal carinae long and strong, extending back well beyond the eye. The area constituting the scrobe distinctly less strongly sculptured than the remainder of the head and its boundaries well defined so that the scrobe is quite distinct. Eyes of moderate size, maximum diameter 0·16. Dorsal alitrunk evenly but shallowly convex in profile, metanotal groove absent. Propodeal spines in profile of moderate length, stout and acute. Metapleural lobes triangular and acute. Petiole blocky and massive, its shape in profile as in Fig. 39. In dorsal view the node distinctly broader than long, massive. Basal border of first gastral tergite in dorsal view with the lateral angles prominent and projecting forwards as a pair of blunt tubercles or teeth. Dorsum of head predominantly longitudinally rugulose anteriorly but from about the level of the eyes the rugulae becoming disorganized and the number of cross-meshes increases posteriorly so that a ruguloreticulum is present occipitally. Dorsal surfaces of alitrunk, petiole and postpetiole reticulate-rugulose. Basal half of first gastral tergite finely but conspicuously longitudinally rugulose with some anastomosis of the rugulae basally, first gastral sternite similarly sculptured. All dorsal surfaces of head and body with abundant long fine hairs. Leading edge of antennal scapes with a row of projecting hairs which are longer than the maximum width of the scape. Dorsal (outer) surfaces of hind tibiae with numerous erect or suberect hairs, the longest of which are distinctly longer than the maximum tibial width. Colour uniform deep reddish brown, the appendages yellowish brown.

PARATYPE WORKERS. As holotype but some lighter in colour. Size range TL 3·0–3·4, HL 0·72–0·82, HW 0·70–0·78, CI 92–97, SL 0·48–0·54, SI 68–73, PW 0·50–0·60, AL 0·80–0·94 (12 measured). Maximum diameter of eye *c.* 0·16–0·18.

Holotype worker, INDIA: Kerala State (W. Ghats), Kottiyoor, Wynaad Taluk 650 m, 7.iv.1969, evgrn forest (*A. B. Soans & W. L. Brown*) (MCZ, Cambridge).

Paratypes. INDIA: 4 workers with same date as holotype; 13 workers, 1 alate female and 4 males, Kerala State (W. Ghats), Silent Valley Reserve, 16 km W. of Mukkali, 9.iv.1969, moist evgn for., 1200 m, litter, rot. wood M244 (*A. B. Soans & W. L. Brown*) [parts of data on undersides of labels] (MCZ, Cambridge; BMNH).

This species is very close to *transversarium* but is larger, more strongly sculptured and has the petiole node less massively developed. More distantly *rugigaster* is related to *mixtum* but in this species the tibiae lack long erect hairs, all which are present being short.

Tetramorium transversarium Roger
(Fig. 40)

Tetramorium transversarium Roger, 1863a : 181. Syntype workers, SRI LANKA (location of types not known).

WORKER. TL 3·0, HL 0·68, HW 0·64, CI 94, SL 0·46, SI 72, PW 0·48, AL 0·80.

Mandibles striate; anterior clypeal margin entire. Frontal carinae reaching back well beyond the level of the posterior margins of the eyes and forming the dorsal margins of the broad, shallow but conspicuous antennal scrobes. Eyes of moderate size, maximum diameter 0·14, about 0·22 × HW. Pronotal corners rounded in dorsal view. Propodeal spines strongly divergent in dorsal view, feebly curved; in profile appearing straight and acute, longer than the elongate-triangular metapleural lobes. Petiole node in profile massive, much larger than postpetiole. Anterior face of node vertical, the anterior half of the dorsum flat, behind this the dorsum sloping to the short, straight posterior face. In dorsal view the petiole node massively transverse, its maximum width *c.* 0·40, almost as broad as the pronotum, its shape in dorsal view as shown in Fig. 40. Anterolateral angles of first gastral tergite produced forwards as a pair of low, rounded, blunt tubercles, not nearly so conspicuous as in other members of the group. Dorsum of head irregularly weakly rugulose, the spaces between rugulae with superficial punctulate ground-sculpture. Dorsal surfaces of alitrunk, petiole and postpetiole irregularly and finely reticulate-rugulose. Basal one-third of first gastral tergite feebly rugulose and with traces of superficial punctulation. All dorsal surfaces of head and body with numerous elongate, fine hairs which are also present on the leading edge of the scape and the dorsal (outer) surface of the hind tibiae. Colour reddish brown.

It seems probable that the types of *transversarium* have been lost or destroyed, and I base my interpretation of this distinctive species upon a single specimen from SRI LANKA: Hakgalam, 1700 m, Hargala (*Mussard*, *Besuchet*, *Löbl*) at present housed in NM, Basle. It is certainly most closely related to the Indian *rugigaster* but in that species the petiole is much less massively developed.

The *scabrosum*-group

Small to minute species with 12-segmented antennae. Sting appendage triangular or dentiform. Anterior clypeal margin entire. Frontal carinae quite strongly developed throughout the group, always reaching back beyond the level of the eyes (Figs 44, 45). Antennal scrobes moderately developed, usually quite distinct even if shallow. Gaster not modified as in *inglebyi*- and *mixtum*-groups. Antennal scapes with a spaced-out row of longer hairs projecting beyond the pubescence or other pilosity, usually arising dorsally on the leading edge of the scape and very commonly directed vertically. Dorsal (outer) surface of hind tibiae with numerous or abundant elongate hairs which are erect or suberect and freely projecting.

The eight species of this group are widely distributed over the Oriental and Indo-Australian regions. One species, *kraepelini*, extends its range into the southern parts of the eastern Palaearctic and one, *tanakai*, is endemic in Japan. All members of the group are small or minute, with a maximum size of TL about 3·0 in the larger species. No members of this group are known from Australia but three occur in New Guinea.

The group appears to be closely related to the *tonganum*-group but in these the frontal carinae tend to be less strongly developed and the scapes and tibiae always lack standing elongate hairs.

Tetramorium aptum sp. n.

HOLOTYPE WORKER. TL 2·6, HL 0·60, HW 0·58, CI 97, SL 0·40, SI 69, PW 0·42, AL 0·70.

Mandibles striate; anterior clypeal margin entire. Frontal carinae distinct, extending back well beyond the level of the eyes but occipitally becoming confused with the reticulate sculpture. Antennal scrobes broad and shallow but easily discernible. Eyes relatively small, maximum diameter *c.* 0·12 so that the diameter of the eye is about 0·20 × HW. Propodeal spines moderate, quite stout, acute apically; metapleural lobes long, acute and triangular, about 0·66 × propodeal spine length. Petiole in profile with the node relatively long and low, the dorsal length of the node greater than the height of the tergal portion. In dorsal view the petiole node about as broad as long, narrowest in front and broadening posteriorly, and more narrowly rounded in front than behind. Dorsum of head weakly longitudinally rugulose to the level of the posterior margins of the eyes, behind this with increasingly numerous cross-meshes and the occipital region finely reticulate-rugulose. Spaces between the rugulae with fine, superficial punctulation,

not conspicuous. Dorsal alitrunk finely reticulate-rugulose, most strongly developed on pronotum. Dorsal surfaces of both petiole and postpetiole covered with rugulose or reticulate-rugulose sculpture and with some punctulation. Gaster unsculptured. All dorsal surfaces of head and body with numerous erect or suberect hairs of varying length. On the head the longest hairs arise from the frontal carinae and on the alitrunk the longest hairs arise in a line along the sides of the dorsum. Antennal scapes with very short, curved pubescence and with a sparse series of longer, stouter hairs which are erect and project vertically. Dorsal (outer) surfaces of hind tibiae with erect or suberect short, stout hairs. Colour uniform light brown, and appendages yellowish.

PARATYPE WORKERS. As holotype but TL 2·6–2·7, HL 0·60–0·62, HW 0·56–0·60, CI 93–96, SL 0·38–0·40, SI 66–68, PW 0·42–0·44, AL 0·70–0·72 (2 measured). Maximum diameter of eye varies *c.* 0·12–0·13 which gives an eye diameter about 0·20–0·23 × HW.

Holotype worker, THAILAND: Nong Hoi, 21.vii.1975 (*D. Jackson*) (BMNH).

Paratypes. 2 workers with same data as holotype (BMNH; MCZ, Cambridge).

This species is also known from three specimens collected in WEST MALAYSIA: Malaya, Salangor, Kepong Waterworks Reserve, 22.viii.67 (*R. Crozier*) (MCZ, Cambridge; BMNH). These match the description above but the extreme apices of the propodeal spines are somewhat upcurved.

Amongst the species of the *scabrosum*-group *aptum* is easily distinguished as it is the only species having both petiole and postpetiole completely sculptured. In one or two other species of the group the postpetiole may be faintly sculptured, but here the petiole is either broader than long or the relative size of the eye is outside the above range, or both.

Tetramorium curtulum Emery
(Fig. 44)

Tetramorium curtulum Emery, 1894 : 471. Syntype workers, BURMA: Palon (*L. Fea*) (probably in MCSN, Genoa).

WORKER. TL 2·8–3·1, HL 0·64–0·74, HW 0·58–0·70, CI 90–94, SL 0·40–0·50, SI 70–75, PW 0·42–0·50, AL 0·68–0·80 (16 measured).

Mandibles striate; anterior clypeal margin arcuate and entire. Frontal carinae long and conspicuous, extending back well behind the eyes. Antennal scrobes quite well developed, distinctly concave. Eyes small, maximum diameter *c.* 0·10–0·14, about 0·16–0·19 × HW. Dorsal alitrunk evenly convex in profile. Propodeal spines quite short, narrow and acute, as long as or only slightly longer than the metapleural lobes which are broad, triangular and acute. Petiole in profile with the dorsal length about equal to the height of the tergal portion of the node. In dorsal view the petiole node is usually as broad as long, but in some specimens it is slightly longer than broad. Dorsum of head to behind level of eyes predominantly or entirely sculptured with spaced-out longitudinal rugulae with few or no cross-meshes, the spaces between the rugulae with faint superficial punctulation. A fine ruguloreticulum is present on the occiput. Dorsal alitrunk with a fine, dense reticulate-rugulation, the same sculpture present on the petiole dorsum but varying from almost as strong as on the alitrunk to very faint. Postpetiole often with faint traces of sculpture on dorsum, more rarely with rugulae developed. Gaster unsculptured. All dorsal surfaces of head and body with numerous hairs; the antennal scapes with a spaced row of longer, stouter hairs projecting beyond the short pubescence and the dorsal (outer) surfaces of the posterior tibiae with numerous erect or suberect quite long hairs. Colour usually uniform yellowish brown but in some darker, reddish brown.

In the *scabrosum*-group this species is recognizable by its reduced eyes, which are fairly conspicuous in the group as most other species have a maximum eye diameter of $>0{\cdot}20 \times$ HW (compare Figs 44 and 45).

I have not been able to see the types of *curtulum* and I am not truly convinced that the material noted below, upon which the above description is based, is really referable to *curtulum* in the sense which Emery originally described it. Whether this doubt is justified or not must await a re-examination of the *curtulum* types.

MATERIAL EXAMINED. WEST MALAYSIA: Malaya, Selangor, Gombak (*R. Crozier*); Gombak (*B. Bolton*). BORNEO: Sarawak, Mt Matang (*G. E. Bryant*); SE. Borneo, 17–46 km W. Batulitjin (*W. L. Brown*).

Tetramorium kraepelini Forel
(Fig. 45)

Tetramorium kraepelini Forel, 1905 : 15. Holotype worker, JAVA: Bogor (= Buitenzorg), 24.ii–12.iii.1904 (*K. Kraepelin*) (MHN, Geneva) [examined].

Tetramorium yanoi Santschi, 1937 : 376, figs 8–10. Syntype workers, JAPAN: Kagoshima-ken, no. 710 (*M. Yano*) (NM, Basle) [examined]. **Syn. n.**

Tetramorium eidmanni Menozzi, 1941 : 21. Nomen nudum [specimens examined, in IE, Bologna]. **Syn. n.**

WORKER. TL 2·1–2·3, HL 0·52–0·64, HW 0·46–0·58, CI 87–93, SL 0·34–0·40, SI 68–74, PW 0·34–0·44, AL 0·56–0·72 (16 measured).

Mandibles striate, anterior clypeal margin entire, arched. Frontal carinae distinct to well behind the level of the eyes but occipitally tending to merge with the other sculpture. Antennal scrobes moderately developed, forming conspicuous though quite shallow and broad impressions on the side of the head. Eyes relatively large, maximum diameter *c.* 0·13–0·17, about 0·26–0·30 × HW. Propodeal spines longer than metapleural lobes, acute, in some populations with a tendency to be slightly upcurved apically. Metapleural lobes triangular and acute. Petiole node in profile with the dorsal length less than the height of the tergal portion, the node tending to become narrower dorsally. In dorsal view the petiole node usually broader than long, less commonly about as broad as long. Dorsum of head predominantly or completely finely longitudinally rugulose to the level of the posterior margins of the eyes, behind which a reticulum is present. Ground sculpture of head a weak, superficial punctulation. Dorsal alitrunk finely reticulate-rugulose. Petiole and postpetiole nodes usually both unsculptured, but in some specimens the petiole may show traces of feeble sculpture. Gaster unsculptured. All dorsal surfaces of head and body with fine standing hairs, the alitrunk with some hairs which are distinctly elongate. Antennal scapes with numerous short hairs and with a spaced row of longer, more conspicuous hairs on the leading edge. Dorsal (outer) surfaces of hind tibiae with elongate erect or suberect hairs. Colour varying from uniform yellowish brown to light mid-brown, sometimes the gaster slightly darker than the alitrunk.

A widespread but apparently not very common species, *kraepelini* shows some variation over its range. Collections are not complete enough as yet to decide if any of these variations are of significance and in consequence I have retained all the samples under a single species. Specimens from the Philippines approach the holotype most closely as in these the peduncle of the petiole is relatively narrow and the node of the petiole in profile narrows dorsally quite conspicuously. In specimens from Japan and China the peduncle of the petiole tends to be broader and the node less narrowed above. In these specimens also the petiole node in dorsal view tends to be more globular and less distinctly transverse than in specimens from elsewhere. Closely related species occur in Japan and Java (*tanakai* and *parvum* respectively); these are best separated by the characters given in the key.

MATERIAL EXAMINED. JAPAN: Kagoshima (*M. Azuma*). CHINA: Foochow (*H. H. Chung*); Mo Man Shan (*W. L. Brown*); Shwangliu (*W. L. Brown*); Szechwan Prov., Chengtu (*W. L. Brown*). PHILIPPINES: Dumaguete (*J. W. Chapman*). JAVA: Karimon (*Dammermann*); Depok (*Dammermann*).

Tetramorium parvum **sp. n.**

HOLOTYPE WORKER. TL 2·7, HL 0·60, HW 0·54, CI 90, SL 0·40, SI 74, PW 0·42, AL 0·72.

Mandibles striate, anterior clypeal margin arcuate and entire, with a narrow but quite conspicuous anterior apron or flange. Frontal carinae weakly developed, only slightly stronger than the cephalic longitudinal sculpture, but extending back well beyond the posterior margins of the eyes and forming the dorsal margins of the shallow but broad antennal scrobes. Maximum diameter of eye *c.* 0·16, about 0·29 × HW. Propodeal spines short, stout and straight, only slightly longer than the broad, triangular metapleural lobes. Peduncle of petiole downcurved, the node narrowing from base to apex in profile and with the dorsal surface about as long as the tergal portion of the node is high. In dorsal view the petiole node about as broad as long, slightly broader behind than in front. Dorsum of head with irregular, feeble longitudinal rugulae to the level of the posterior margins of the eyes but behind this cross-meshes become numerous and a reticulum is present on the occiput. Ground sculpture of superficial punctulation is quite conspicuous and on the whole the cephalic sculpture has a disorganized appearance. Dorsal alitrunk with a rugoreticulum, the components of which are low and blunted on the promesonotum.

Petiole dorsally with weak but fairly conspicuous rugulae present, the postpetiole and gaster unsculptured. All dorsal surfaces of head and body with numerous fine erect or suberect hairs. Antennal scapes with a spaced row of long hairs projecting dorsally and dorsal (outer) faces of hind tibiae with numerous stout erect or suberect hairs. Colour uniform blackish brown, the legs yellowish brown.

Paratype worker. As holotype but slightly lighter in colour, uniform dark brown, with measurements TL 2·6, HL 0·60, HW 0·56, CI 93, SL 0·40, SI 71, PW 0·42, AL 0·72. Maximum diameter of eye *c.* 0·16.

Holotype worker, Java: Tjibodas, 23.x.73 (*B. Bolton*) (BMNH).

Paratype. Java: 1 worker, Tjibodas, 1500 m, 8.vii.1920, Mus. Btzg. no. 30 (MCZ, Cambridge).

This small species is a sibling of *kraepelini*, separated from it by the darker colour and weaker, more disorganized sculpture seen in *parvum*.

Tetramorium pulchellum Emery
(Figs 42, 43)

Tetramorium pulchellum Emery, 1897a : 586, pl. 15, fig. 28. Syntype workers, New Guinea: Berlinhafen and Friedrich-Wilhelshafen (*L. Biró*) (probably in MCSN, Genoa).

Worker. TL 2·8–3·0, HL 0·64–0·68, HW 0·58–0·62, CI 88–91, SL 0·48–0·54, SI 80–85, PW 0·46–0·50, AL 0·82–0·86 (6 measured).

Mandibles striate, anterior clypeal margin entire. Frontal carinae strong, extending back well beyond the level of the posterior margins of the eyes but not reaching the occiput. Antennal scrobes conspicuous. Maximum diameter of eye *c.* 0·14–0·16, about 0·23–0·26 × HW. In dorsal view the pronotal corners broadly rounded, not at all angular. Propodeal spines short, broad and acute, elevated and slightly upcurved. Metapleural lobes generally broad and more or less rounded or very bluntly rounded-triangular. Petiole in profile with the dorsal surface as long as or slightly longer than the height of the tergal portion of the node, in dorsal view the node slightly broader than long. Head quite coarsely and very conspicuously reticulate-rugulose dorsally, the rugular cross-meshes occurring from the level of the anterior margins of the eyes at least, and usually with some in front of this level. Ground sculpture a feeble and inconspicuous punctulation. Dorsal alitrunk strongly reticulate-rugulose, this sculpture extending onto the petiole and postpetiole though weaker on the former and yet weaker on the latter; gaster unsculptured. All dorsal surfaces of head and body with abundant fine hairs of varying length which are erect, suberect or subdecumbent. Dorsal (outer) surfaces of hind tibiae with numerous long hairs, predominantly suberect; the antennal scapes also with erect but shorter hairs. Colour uniform brown, the legs yellowish.

In the *scabrosum*-group two of the New Guinean species, *pulchellum* and *scabrosum*, are conspicuous by their relatively coarse reticulate-rugulose cephalic sculpture. The two are easily separable as in *scabrosum* the pronotal corners are distinctly angular whilst in *pulchellum* they are rounded (compare Figs 41, 42). In the remainder of the group (not New Guinean species) the sculpture of the head tends to be predominantly or entirely longitudinal to the level of the posterior margins of the eyes, any strong reticulation which is present being restricted to the occipital region.

Material examined. New Guinea: Wau (*S. Peck*).

Tetramorium punctiventre Emery

Tetramorium punctiventre Emery, 1887 : 453. Holotype female, New Guinea: Hatam (*Beccari*) (probably in MCSN, Genoa).

I have not seen the holotype of this species, nor have I been able to find any material matching the original description. From that description it is not possible to decide whether *punctiventre* is correctly placed in *Tetramorium* or should go into *Triglyphothrix*, and Emery's comparison of this species with *Tr. lanuginosa* does little to settle the matter. For the present and with some misgivings I tentatively place *punctiventre* in the *scabrosum*-group, fully realizing that this may prove to be incorrect.

The principal characters of this enigmatic species are as follows. First gastral tergite basally punctate and with longitudinal rugulae. Propodeal spines long. Petiole node in dorsal view transversely ovate. Frontal carinae produced back beyond the level of the eyes, the antennal scrobes broad. Mandibles striate. Dominant sculpture on head and alitrunk a dense rugose-punctation.

In *Tetramorium* species of these regions gastral sculpture of the form described is very rare, but in *Triglyphothrix* gastral sculpture is reasonably common (Bolton, 1976), though of these species only the very conspicuous *fulviceps* is known to occur in New Guinea and this is certainly not equatable with *punctiventre*.

Tetramorium scabrosum (F. Smith)
(Fig. 41)

Myrmica scabrosa F. Smith, 1859 : 147. LECTOTYPE worker, Aru Is (*A. R. Wallace*) (UM, Oxford), here designated [examined].

Tetramorium scabrosum (F. Smith) Donisthorpe, 1932 : 455 (see note below).

Tetramorium papuanum Emery, 1887 : 452. Syntype workers, New Guinea: Sorong, v.1872 (*L. M. D'Albertis*) (MHN, Geneva) [examined]. **Syn. n.**

Note. Donisthorpe (1932) stated that two workers of this species were present in UM, Oxford collection, but at present only one can be found. There is a second specimen of this species in BMNH which may represent one of the two seen by Donisthorpe, but this has no data-cards attached to it.

Worker. TL 2·7–2·8, HL 0·62–0·64, HW 0·56–0·58, CI 90, SL 0·44–0·46, SI 78–79, PW 0·44–0·46, AL 0·68–0·72 (3 measured).

Mandibles striate, anterior clypeal margin entire. Frontal carinae reaching back well beyond the level of the eyes but not much more strongly developed than the other cephalic sculpture. Antennal scrobes weakly developed, broad and shallow but quite easily discernible. Maximum diameter of eye *c.* 0·16, about 0·27–0·28 × HW. With the alitrunk in dorsal view the pronotal corners angular, giving a square-shouldered appearance. Propodeal spines quite short, stout and acute, slightly longer than the broadly triangular metapleural lobes. Node of petiole in profile with the dorsal length less than the height of the tergal portion; in dorsal view the node broader than long. Dorsum of head distinctly reticulate-rugulose from the level of the anterior margins of the eyes to the occiput, ground sculpture between the rugulae very inconspicuous. Dorsal alitrunk similarly sculptured but the petiole dorsum with only weak, very scattered rugulae and the postpetiole virtually without sculpture dorsally. Gaster unsculptured. All dorsal surfaces of head and body with numerous fine, erect or suberect hairs which are also present on the leading edges of the scapes and the outer surfaces of the hind tibiae. Colour uniform dark brown or dark reddish brown, the gaster blackish brown. Appendages lighter, yellowish brown.

Like *pulchellum* this small species has rather coarse cephalic sculpture, but differs from it as the pronotal corners are angular in *scabrosum*, rounded in *pulchellum*, as indicated in Figs 41 and 42.

Tetramorium tanakai sp. n.

Holotype worker. TL 2·6, HL 0·62, HW 0·56, CI 90, SL 0·40, SI 71, PW 0·42, AL 0·70.

Mandibles striate, anterior clypeal margin entire. Frontal carinae more strongly developed than remaining cephalic sculpture, reaching back beyond the level of the posterior margin of the eyes but occipitally becoming confused with the other sculpture. Antennal scrobes very shallow, fairly conspicuous but broad and not very strongly defined. Eyes of moderate size, maximum diameter 0·14, about 0·25 × HW. Propodeal spines tapering and acute, longer than the broadly triangular metapleural lobes. Petiole in profile with the length of the dorsum greater than the height of the tergal portion of the node, in dorsal view as broad as long, roughly subglobular in shape and somewhat narrower in front than behind. Dorsum of head finely longitudinally rugulose to behind the level of the posterior margins of the eyes, with few or no cross-meshes; occipital area with a fine ruguloreticulum. Ground sculpture of head inconspicuous. Dorsal alitrunk finely reticulate-rugulose, the petiole dorsally retaining some faint traces of sculpture but the postpetiole and gaster unsculptured. All dorsal surfaces of head and body with numerous fine erect or suberect hairs of varying length. Dorsal (outer) surfaces of hind tibiae and the antennal scapes with projecting prominent hairs. Head and gaster dark brown or blackish brown, the alitrunk, pedicel and legs much lighter, yellow to pale yellowish brown so that the ant has a distinctly bicoloured appearance.

Paratype workers. As holotype but in some the metapleural lobes are blunted and rounded apically. Range of dimensions TL 2·4–2·6, HL 0·58–·062, HW 0·52–0·56, CI 89–91, SL 0·36–0·40, SI 69–73, PW 0·38–0·42, AL 0·66–0·70 (23 measured). Maximum diameter of eye *c.* 0·14 so that the ocular diameter is about 0·25–0·27 × HW.

Holotype worker, JAPAN: Okinawa, Ishigaki I., Mt Omoto, 1.iii.1975 (*M. Tanaka*) (BMNH).

Paratypes. 58 workers and 1 female with same data as holotype (BMNH; MCZ, Cambridge; NM, Basle; private coll. Tanaka).

This small species is closely related to *kraepelini* but is separable by its distinct colour pattern and differently shaped node. In *kraepelini* the colour is usually uniform, light yellowish brown to light mid-brown, not distinctly bicoloured as *tanakai*. The petiole node shows some variation in shape in *kraepelini* but in profile the dorsal length is always less than the height of the tergal portion of the node, whereas in *tanakai* the dorsal length is greater than the height of the tergal portion.

The *ciliatum*-group

Antennae with 12 segments. Sting appendage triangular or dentiform. Anterior clypeal margin entire, not notched or indented medially. Frontal carinae extending back well beyond the level of the posterior margins of the eyes, ranging in development from feeble in *curvispinosum* to very strong in *ciliatum*. Propodeal spines long and usually strongly developed, never downcurved along their length. Gaster without modification as shown in *mixtum*-group.

This is very much a convenience-group, formed of the larger, stout, stockily built and usually quite hairy species which remain of *Tetramorium* outside the *ornatum*- and *bicarinatum*-groups. In general the sculpture in these species is coarse and distinctive. Within the group the species-complex *ciliatum–flagellatum–tylinum* are closely related, as is the species pair *chapmani–khnum*, but the two remaining species (*curvispinosum* and *zypidum*) are not obviously related to any other known species.

The constituent species are distributed in the Oriental and Indo-Australian regions; no species are known from Australia or from New Guinea.

Tetramorium chapmani sp. n.
(Figs 46, 47)

HOLOTYPE WORKER. TL 3·5, HL 0·80, HW 0·76, CI 95, SL 0·56, SI 74, PW 0·58, AL 0·96.

Mandibles striate; anterior clypeal margin entire. Frontal carinae long and strongly developed, reaching back almost to the occipital corners and surmounted by a narrow but quite distinct raised ridge or flange to behind the level of the eyes. Antennal scrobes conspicuous, extending back almost to the occipital corners. Maximum diameter of eye *c.* 0·14, the eyes situated in front of the middle of the sides of the head. Sides of head weakly convex, the occipital margin strongly impressed medially. Dorsum of alitrunk evenly convex in profile, the propodeal spines of moderate length, narrow, straight and acute. Metapleural lobes broadly triangular, acute apically. Shape of petiole and postpetiole, in profile as shown in Fig. 47. In dorsal view the petiole node globular. Entire dorsum of head from posterior clypeal margin to occiput covered with a dense, quite coarse rugoreticulum, the meshes of which are sharply defined and raised; the spaces enclosed by the meshes mostly smooth, at most with only vestigial ground sculpture. Area of antennal scrobes predominantly punctulate, with very reduced rugulae, contrasting strongly with the dorsum. Entirety of dorsal alitrunk, petiole and postpetiole sculptured as dorsum of head, but the pedicel segments rather less conspicuously so. Basal half of first gastral tergite densely and strongly longitudinally striate, the spaces between the striae with superficial punctulation. First gastral sternite sculptured but less strongly than the tergite. Relatively short, fine hairs numerous on all dorsal surfaces of head and body but hairs on scapes and dorsal (outer) surfaces of hind tibiae universally short, decumbent. Colour uniform orange-brown but the tibiae yellow-brown, distinctly lighter in colour than the femora.

PARATYPE WORKERS. As holotype but showing colour variations from orange-yellow to light reddish brown but always with the contrasting femoral-tibial colours. Range of dimensions are TL 3·2–3·5, HL 0·74–0·80, HW 0·72–0·78, CI 95–98, SL 0·54–0·60, SI 72–79, PW 0·54–0·60, AL 0·90–0·96 (13 measured).

Holotype worker, PHILIPPINES: Dumaguete, Silliman University, xii.1950 (*Domingo Empeso*) (MCZ, Cambridge).

Paratypes. 13 workers with same data as holotype (MCZ, Cambridge; BMNH; NM, Basle).

A very conspicuous species, *chapmani* is closely related to *khnum*, also of the Philippines. The two are easily distinguished as *khnum* lacks the gastral sculpture characteristic of *chapmani*.

Tetramorium ciliatum sp. n.
(Fig. 49)

HOLOTYPE WORKER. TL 3·9, HL 0·88, HW 0·86, CI 98, SL 0·68, SI 79, PW 0·62, AL 1·08.

Mandibles striate, anterior clypeal margin entire. Frontal carinae very strongly developed, approaching the occipital corners and composed throughout their length of a low but conspicuous flange or raised rim. Antennal scrobes well developed, distinct, extending back beyond the level of the eyes and not as strongly sculptured as the remainder of the head. Eyes slightly in front of the middle of the feebly convex sides of the head, their maximum diameter *c.* 0·18. Occipital margin broadly but shallowly concave. Propodeal spines long, narrow and acute, the metapleural lobes low and triangular, acute apically. Node of petiole in profile long and low, the length of the dorsum greater than the height of the tergal portions. Anterior and posterior faces of the node short, the dorsum long and convex (Fig. 49). Postpetiole in profile low and evenly rounded. Petiole in dorsal view fractionally longer than broad, subglobular in shape. Entire dorsum of head covered with a fine, wide-meshed but very conspicuous rugoreticulum, the spaces enclosed by the meshes mostly smooth, with some vestigial ground-sculpture. Dorsal surfaces of alitrunk, petiole and postpetiole with an open, loose but strongly marked rugoreticulum, less strongly developed on the pedicel segments than on the alitrunk. Gaster unsculptured. All dorsal surfaces of head and body with abundant erect hairs, some of which are long. Anterior (leading) edges of antennal scapes with a spaced row of long, erect hairs which are longer than the maximum width of the scape; dorsal (outer) surfaces of hind tibiae with a number of long, erect hairs, the longest of which are at least equal to the maximum tibial width. Colour midbrown, the gaster darker brown, the legs lighter, dark yellowish brown.

PARATYPE WORKERS. As holotype, showing some variation in shade of colour and in size, TL 3·6–4·2, HL 0·80–0·96, HW 0·80–0·94, CI 97–100, SL 0·60–0·70, SI 71–79, PW 0·58–0·70, AL 0·98–1·14 (25 measured). Maximum diameter of eye *c.* 0·15–0·18.

Holotype worker, THAILAND: Nong Hoi (Chieng Mai), 27.vii.1975 (*D. Jackson*) (BMNH).

Paratypes. 90 workers with same data as holotype and 15 workers, 3 queens as holotype but collected 19.viii.1975 (BMNH; MCZ, Cambridge; NM, Basle; MHN, Geneva; IE, Bologna; MNHU, Berlin; CAS, San Francisco). The species is also present in VIETNAM: between Phong Tho and Bac tan trac (*R. E. Wheeler*), specimens in BMNH and MCZ, Cambridge.

The closest known relative of *ciliatum* appears to be *flagellatum* of Borneo, but in this latter species the hairs are incredibly long and the pedicel segments are differently shaped, compare Figs 48 and 49.

Tetramorium curvispinosum Mayr
(Fig. 50)

Tetramorium curvispinosum Mayr, 1897 : 430. Holotype worker, SRI LANKA: Kalawewa (*Madarasz*) (location of type not known).

WORKER. TL 3·2–3·6, HL 0·72–0·80, HW 0·66–0·72, CI 88–93, SL 0·52–0·58, SI 78–83, PW 0·48–0·52, AL 0·88–0·94 (13 measured).

Mandibles striate; anterior clypeal margin entire. Frontal carinae extending back behind the level of the eyes but the carinae themselves irregular and feeble, in the posterior half of their length scarcely or not more strongly developed than the other cephalic sculpture. Antennal scrobes very weak, scarcely recognizable. Eyes of moderate size, maximum diameter *c.* 0·14–0·16. Propodeal spines exceptionally long, stout but acute apically (Fig. 50). In dorsal view the spines are strongly bowed, their apical halves converging posteriorly. Metapleural lobes short, triangular and acute. Propodeum in profile with a long anterior peduncle and a short, high node, the dorsal length of which is distinctly less than the height of the tergal portion. Node of petiole in dorsal view as long as or slightly longer than broad. Dorsum of head irregularly longitudinally rugose with very few cross-meshes to the level of the posterior margins of the eyes, behind this level with a rugoreticulum. Dorsal alitrunk with a loose, open rugoreticulum, the meshes of which are broad. Petiole and postpetiole unsculptured or at most with some faint rugulation. Gaster unsculptured. All dorsal surfaces of head and body with numerous long, fine hairs. Anterior (leading) edge of scapes and dorsal (outer) surfaces of hind tibiae with long erect or suberect hairs, the longest of which are at least subequal to the maximum width of the appendage from which they arise, usually longer. Head and alitrunk orange-brown; pedicel, gaster and appendages yellowish or yellowish brown.

The form of the propodeal spines in this species appears to be unique in the genus and serves quickly to distinguish the species. *T. curvispinosum* does not appear to have any immediate relatives but the long spines and elongate peduncle of the petiole are more reminiscent of members of the *tortuosum*-group. However, the 12-segmented antennae and dentiform sting appendage of *curvispinosum* exclude it from that group and I have placed it in *ciliatum*-group for the time being.

MATERIAL EXAMINED. SRI LANKA: Kandy (*E. O. Wilson*).

Tetramorium flagellatum sp. n.

(Fig. 48)

HOLOTYPE WORKER. TL 3·9, HL 0·90, HW 0·82, CI 91, SL 0·66, SI 80, PW 0·62, AL 1·04.

Mandibles striate; anterior clypeal margin entire. Frontal carinae reaching back almost to occiput but irregular, and in their posterior halves only as strongly developed as the other cephalic sculpture. Antennal scrobes long and broad but shallow, easily discernible. Eyes in front of middle of sides of head, maximum diameter *c.* 0·18. Sides of head weakly convex, the occipital margin broadly concave in full-face view. Propodeal spines elevated, of moderate length, feebly upcurved and acute apically. Metapleural lobes triangular basally, spiniform and acute apically. Node of petiole in profile with the dorsal length greater than the height of the tergal portion; postpetiole narrowly dome-like. In dorsal view the petiole node slightly broader than long. Dorsal surfaces of head, alitrunk, petiole and postpetiole covered with a distinct, irregular rugulation, reticulate in places and finer and denser on the head than on the alitrunk. Gaster unsculptured. All dorsal surfaces of head and body with numerous exceptionally long, very conspicuous fine hairs, the majority of which are curved (Fig. 48). The longest of these hairs measure 0·45–0·50, well over half the length of the scape. Long, erect hairs present on dorsal (outer) surfaces of hind tibia which are longer than the maximum tibial width but such hairs absent from the scapes where all hairs are shorter than the maximum width of the scape and fine. Colour uniform dark brown, the appendages yellowish.

PARATYPE WORKERS. As holotype but many not showing any apical upcurvature in the propodeal spines, which in some paratypes are also more strongly acute apically. Size range of paratypes TL 3·6–4·2, HL 0·88–0·98, HW 0·80–0·90, CI 90–95, SL 0·62–0·70, SI 75–80, PW 0·60–0·68, AL 1·02–1·16 (6 measured). Maximum diameter of eye in paratypes *c.* 0·18–0·20.

Holotype worker, BORNEO: N., Kiduk Arok, Trus Madi Massif, 1500 m, ix.1956, Cambridge N. Borneo Exped. no. 49 (*P. W. Bryant*) (MCZ, Cambridge).

Paratypes. 5 workers with same data as holotype and 1 worker with same data but no. 78 (MCZ, Cambridge; BMNH).

A further specimen of this species is known, BORNEO: N., Mt Musud (*F. Mjoberg*) (MCZ, Cambridge). This agrees perfectly with the above description but the head and alitrunk are a much lighter brown than in any of the type-series.

The outstanding long pilosity and its distribution on the appendages immediately characterize this exceptional species. It shows relationship with *ciliatum* of Thailand and Vietnam and also with *tylinum*, also of Borneo. However, neither of these species has the remarkable pilosity of *flagellatum*.

Tetramorium khnum sp. n.

(Fig. 52)

HOLOTYPE WORKER. TL 3·1, HL 0·74, HW 0·70, CI 94, SL 0·48, SI 69, PW 0·54, AL 0·84.

Mandibles striate; anterior clypeal margin entire. Frontal carinae long and strongly developed, reaching well beyond the posterior margins of the eyes, almost to the occipital corners. Antennal scrobes long and broad, moderately deep, conspicuous, their reticulate-punctulate sculpture contrasting strongly with the rugosity of the remainder of the head. Eyes of moderate size, maximum diameter *c.* 0·16. Propodeal spines acute, narrow and relatively short, only as long as or slightly longer than the broad, somewhat upcurved metapleural lobes. Petiole in profile with the dorsal length of the node greater than the height of its tergal portion, the anterior face slightly higher than the posterior (Fig. 52). Node in dorsal view broader than long. Dorsum of head covered by a coarse dense, close rugoreticulum, the meshes of which are small and appear reticulate-foveolate in places. Dorsal surfaces of alitrunk, petiole and postpetiole similarly sculptured; gaster unsculptured. All dorsal surfaces of head and body with numerous fine hairs

of varying length. Leading edge of antennal scapes with numerous short hairs and also with a spaced row of longer, stouter hairs which are subequal in length to the maximum width of the scape. Dorsal (outer) surface of hind tibiae with outstanding fine, erect or suberect hairs. Colour reddish brown, the gaster lighter in shade than the alitrunk, and with the legs yellowish.

Paratype workers. As holotype but range of measurements TL 2·8–3·2, HL 0·70–0·76, HW 0·66–0·74, CI 92–97, SL 0·46–0·50, PW 0·52–0·58, AL 0·74–0·86 (16 measured). Maximum diameter of eye *c.* 0·14–0·16.

Holotype worker, Philippines: Dumaguete, 23.iv.1925 (*J. W. Chapman*) (MCZ, Cambridge).

Paratypes. 10 workers with same data as holotype and 13 workers with same locality data but 'Camp', 6.iv.1931, no. 1 (*J. W. Chapman*) (MCZ, Cambridge; BMNH; NM, Basle).

More material of this species is present in the Chapman collection, housed in MCZ, Cambridge, but it is in rather poor condition. All specimens originate from Dumaguete, the type-locality.

Two other species of this group occur in the Philippines besides *khnum*. These are *chapmani*, which is easily distinguished as the first gastral tergite is strongly sculptured basally, and *zypidum* in which the petiole and postpetiole are almost or entirely unsculptured.

***Tetramorium tylinum* sp. n.**
(Fig. 53)

Holotype worker. TL 3·7, HL 0·84, HW 0·80, CI 95, SL 0·62, SI 77, PW 0·60, AL 0·98.

Mandibles striate; anterior clypeal margin entire. Frontal carinae long, extending back almost to the occipital corners, but only weakly developed. Over most of their length the frontal carinae are no more strongly developed than the other cephalic sculpture. Antennal scrobes poorly developed, very shallow but still quite easily visible. Eyes situated well in front of the midlength of the sides of the head in full-face view, their maximum diameter *c.* 0·18. Occipital margin of head strongly concave medially in full-face view. Alitrunk in profile evenly convex, the propodeal spines straight, strongly tapered apically and very sharp. Metapleural lobes acutely triangular, somewhat upcurved. Petiole in profile shaped as in Fig. 53, without a defined posterodorsal angle so that the dorsum rounds into the posterior face. In dorsal view the petiole node is slightly broader than long. Dorsum of head with a fine, dense and somewhat irregular rugoreticulum, the area of the antennal scrobes more finely and more densely sculptured, having a rough appearance. Dorsal surfaces of alitrunk and petiole finely reticulate-rugose, the latter less strongly so than the former. Dorsum of postpetiole unsculptured centrally and mostly so elsewhere, but with some traces of rugulae around the sides of the dorsum. Gaster unsculptured. All dorsal surfaces of head and body with abundant fine, erect or suberect hairs of varying length. Longest hairs on scapes not equal to the width of the scape, without a spaced row of elongate hairs. Dorsal (outer) surfaces of hind tibiae with abundant short hairs but without long prominent hairs. Colour dark reddish brown, the appendages yellowish.

Paratype workers. As holotype: TL 3·6–3·7, HL 0·84–0·86, HW 0·80–0·82, CI 95–97, SL 0·60–0·64, SI 74–80, PW 0·58–0·62, AL 0·96–1·00 (5 measured). Maximum diameter of eye *c.* 0·18 in all paratypes.

Holotype worker, Borneo: N., Kiduk Arok, Trus Madi Massif, 1500 m, ix.1956, no. 21, Cambridge N. Borneo Exped. (*P. W. Bryant*) (MCZ, Cambridge).

Paratypes. 5 workers with same data as holotype but no. 34A (MCZ, Cambridge; BMNH).

The closest known relative of *tylinum* is *flagellatum*, which is also known from the same locality in Borneo. *T. flagellatum* is quickly separable from *tylinum* by its exceptionally long pilosity and the presence of long, erect hairs on the outer surface of the hind tibiae.

***Tetramorium zypidum* sp. n.**
(Fig. 51)

Holotype worker. TL 3·8, HL 0·90, HW 0·84, CI 93, SL 0·62, SI 74, PW 0·58, AL 1·04.

Mandibles striate; anterior clypeal margin entire but exceedingly shallowly concave medially. Frontal carinae extending back almost to occipital corners but behind level of eyes becoming very weak, scarcely or not more strongly developed than the other cephalic sculpture. Antennal scrobes shallow and broad, only feebly developed. Occipital margin of head distinctly concave medially in full-face view. Eyes moderate, maximum diameter *c.* 0·19, the eyes situated in front of the middle of the sides of the head. Dorsal alitrunk evenly, shallowly convex in profile, the propodeal spines long, thick, acute and feebly sinuate

along their length, the apices very weakly upcurved. Metapleural lobes narrowly triangular and acute. Shape of petiole in profile as shown in Fig. 51; in dorsal view the node distinctly longer than broad. Dorsum of head predominantly longitudinally rugose with very few cross-meshes to the level of the posterior margins of the eyes, behind this a strong reticulum is developed. Dorsal alitrunk reticulate-rugose. Sides of petiole node with some weak rugosity but the dorsum with an unsculptured median longitudinal strip. Postpetiole and gaster unsculptured. All dorsal surfaces of head and body with quite short erect or suberect hairs. Leading (anterior) margin of antennal scapes with pubescence and also with a spaced row of short, erect hairs. Dorsal (outer) surfaces of hind tibiae with short erect or suberect hairs. Colour reddish brown, the legs dull orange-brown.

PARATYPE WORKERS. As holotype but some slightly lighter in colour, dull orange-brown. Measurements TL 3·3–4·0, HL 0·80–0·98, HW 0·72–0·90, CI 90–94, SL 0·54–0·64, SI 69–75, PW 0·52–0·64, AL 0·90–1·12 (21 measured).

Holotype worker, PHILIPPINES: Dumaguete, Camp, 14.iv.1931 (*J. W. Chapman*) (MCZ, Cambridge).

Paratypes. PHILIPPINES: 3 workers with same data as holotype; 6 workers as holotype but 3.iv.1931, no. 11; 3 workers as holotype but iv.1928; 3 workers as holotype but 1.iv.1931; 3 workers as holotype but 20.iv.1931; 3 workers, Negros Oriental, Camp, 30.viii.1930 (*F. del Rosario*) (MCZ, Cambridge; BMNH; NM, Basle).

The *tonganum*-group

Antennae with 12 segments. Sting appendage triangular or dentiform. Anterior clypeal margin entire, not notched or indented medially. Frontal carinae extending back beyond the level of the posterior margins of the eyes but usually only weakly developed, often no more strongly defined than the remaining cephalic sculpture. Propodeal spines varying from absent (*infraspinum*) to moderately long (*seneb*) but usually only about as long as the metapleural lobes. First gastral tergite not modified as in *mixtum*-group. Dorsal surfaces of head and body with numerous fine hairs but the antennal scapes and dorsal (outer) surfaces of the hind tibiae only with short subdecumbent to appressed pubescence (in *vandalum* this pubescence may be erect or suberect), these surfaces devoid of elongate hairs.

The members of this group of small to medium-sized species are very widespread in the Oriental and Indo-Australian regions but do not occur in Australia. In most species the known range is relatively small but the distribution area of *tonganum* is wide and the species has been known to occur in hothouses in the temperate zones.

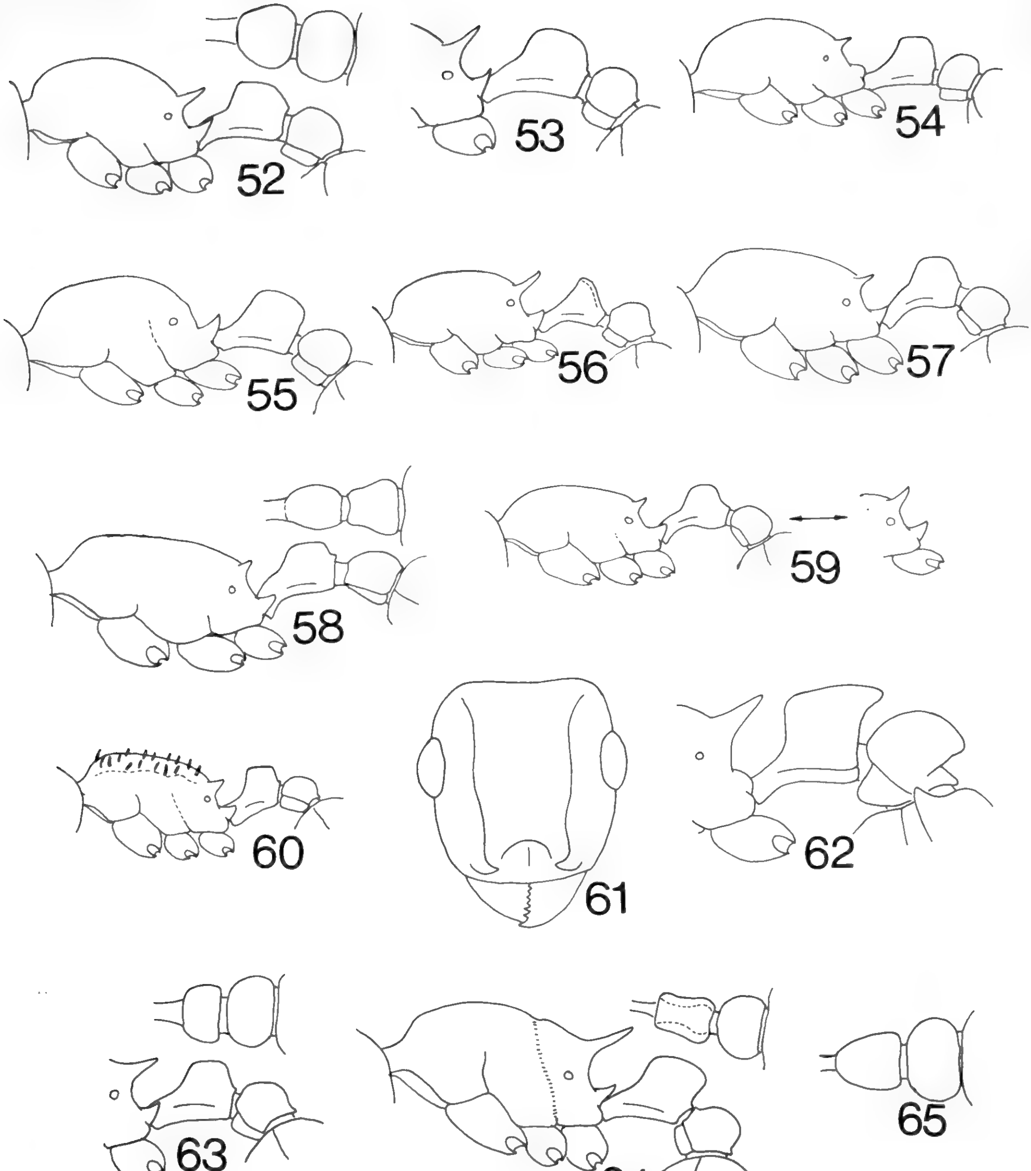
The group is centred upon a complex of more or less closely related species including *christiei*, *difficile*, *laparum*, *tonganum* and *vandalum*, the remaining species tending to be more isolated. One species, *infraspinum*, may not truly belong to this group but for the present it is left here to avoid a proliferation of groups containing only a single species. However, should the need arise to isolate *infraspinum* it is easily accomplished as it lacks propodeal spines. I have decided for the present that this character is of secondary importance to that of the distribution of hairs (or lack of them) on the appendages, the main character separating *tonganum*-group from *scabrosum*-group.

Tetramorium christiei Forel
(Fig. 58)

Tetramorium christiei Forel, 1902a : 232. Syntype workers, INDIA: Darjeeling (*Christie*) (MHN, Geneva; BMNH) [examined].

WORKER. TL 3·4–3·5, HL 0·78–0·80, HW 0·70–0·72, CI 87–90, SL 0·62–0·64, SI 87–91, PW 0·50–0·52, AL 0·94–0·98 (4 measured).

Mandibles striate; anterior clypeal margin entire. Frontal carinae reaching back almost to occiput but only weakly developed, only a little stronger than the remaining cephalic sculpture. Antennal scrobes feeble but distinct, their ventral margins not at all demarcated. Eyes of moderate size, maximum diameter *c.* 0·16. Antennal scapes narrow and relatively long (SI above). Anterolateral pronotal angles rounded in dorsal view. Propodeal spines dentiform, acute, usually much shorter than the triangular metapleural lobes (but in the Bhutan specimen slightly longer). Petiole in profile with an elongate, feebly downcurved peduncle anteriorly, the node itself with rounded angles (Fig. 58). In dorsal view the petiole node varies



Figs 52–65. *Tetramorium* workers. 52–60. Alitrunk and pedicel of (52) *khnum*, (53) *tylinum*, (54) *salvatum*, (55) *infraspinosum*, (56) *cuneinode*, (57) *vandalum*, (58) *christiei*, (59) *tonganum*, (60) *simillimum*. 61. Head of *megalops*. 62, 63. Propodeum and pedicel of (62) *spininode*, (63) *confusum*. 64. Alitrunk and pedicel of *strictum*. 65. Dorsal pedicel of *turneri*. Sculpture and pilosity omitted in all but 60.

from as broad as long to slightly broader than long. Rugulation of head predominantly longitudinal to region of occiput, with few or no cross-meshes, but with some feeble reticulation on the occiput itself. Dorsal alitrunk finely reticulate-rugulose, the petiole, postpetiole and gaster unsculptured. All dorsal surfaces of head and body with numerous fine hairs of varying length but the scapes and hind tibiae only with short, decumbent pubescence. Colour uniform black or blackish brown.

This species is known only from the type-series and from the single specimen mentioned below. The propodeal spines are longer in the Bhutan specimen than in the types and the sculpture is somewhat more conspicuous, but the similarities far outweigh the differences and I have no doubt that the Bhutan specimen represents a variant within the limits of *christiei*. The species is related to *tonganum* and its allies but is separated by its relatively long scapes and uniformly dark colouring.

MATERIAL EXAMINED. BHUTAN: Phuntsholing (*C. Baroni Urbani*).

Tetramorium cuneinode sp. n.

(Fig. 56)

HOLOTYPE WORKER. TL 2·5, HL 0·56, HW 0·54, CI 96, SL 0·36, SI 67, PW 0·38, AL 0·68.

Mandibles striate; anterior clypeal margin entire. Frontal carinae weak, scarcely more strongly developed than the remaining cephalic sculpture; extending back beyond the level of the eyes but posteriorly blending with the other cephalic sculpture. Antennal scrobes feeble but discernible, scapes short. Eyes of moderate size, maximum diameter 0·14, about 0·26 × HW. Propodeal spines in profile quite long, slightly upcurved at the extreme apex. Metapleural lobes elongate-triangular and acute. Node of petiole wedge-shaped in profile, broadest below and narrowing strongly above (Fig. 56), the dorsal and posterior faces fused into a single steep surface which is feebly convex. Postpetiole rounded and normal. In dorsal view the petiole node much broader than long. Dorsum of head predominantly longitudinally rugulose to level of posterior margins of eyes, behind this finely reticulate-rugulose. Dorsal alitrunk reticulate-rugulose. Petiole, postpetiole and gaster unsculptured. Dorsal surfaces of head and body with numerous fine hairs but antennal scapes and dorsal (outer) surfaces of hind tibiae with only short, subdecumbent to decumbent pubescence, without long hairs. Colour uniform yellow-brown, the appendages lighter than the body.

PARATYPE WORKERS. TL 2·3–2·6, HL 0·54–0·58, HW 0·50–0·56, CI 92–96, SL 0·34–0·38, SI 67–69, PW 0·36–0·40, AL 0·62–0·70 (4 measured). Maximum diameter of eye *c.* 0·13–0·14. Otherwise as holotype.

Holotype worker, THAILAND: Nong Hoi, 19.vii.1975 (*D. Jackson*) (BMNH).

Paratypes. 3 workers with same data as holotype and 1 worker with same data but collected 20.vii.1975 (BMNH; MCZ, Cambridge).

The shape of the petiole seen in this small species is unique in the regions at present under discussion. It resembles most closely the shape found in some members of the African *squaminode*-group, but in these the sting appendage is spatulate, not dentiform as in *cuneinode*. The closest relative of *cuneinode* appears to be *seneb*, a species known from Malaya and Java, but here the petiole is nodiform and not modified as described above.

Tetramorium difficile sp. n.

HOLOTYPE WORKER. TL 2·4, HL 0·56, HW 0·52, CI 93, SL 0·40, SI 77, PW 0·38, AL 0·64.

Mandibles striate; anterior clypeal margin entire and the median portion with a narrow anterior flange or apron. Frontal carinae well developed, reaching back well beyond the level of the eyes and forming the upper borders of the shallow but quite distinct antennal scrobes. Maximum diameter of eye *c.* 0·12, about 0·23 × HW. Propodeal spines short and dentiform, slightly shorter than the short, bluntly triangular metapleural lobes. Petiole in profile with a slightly downcurved anterior peduncle, the node itself has rounded anterodorsal and posterodorsal angles and the tergal portion is slightly higher than the length of the dorsum. Postpetiole in profile evenly convex. In dorsal view the petiole node is slightly broader than long and the postpetiole is only slightly broader than the petiole. Dorsum of head weakly longitudinally rugulose, with some feeble reticulation occipitally. Dorsal alitrunk finely reticulate-rugulose, the petiole node with faint traces of rugulation dorsally. Postpetiole and gaster unsculptured and shining. All dorsal surfaces of head and body with numerous fine hairs of varying length but the scapes and dorsal (outer) surfaces of the hind tibiae only with short, decumbent or appressed pubescence, without longer hairs. Colour uniform yellowish brown.

PARATYPE WORKER. As holotype, TL 2·3, HL 0·54, HW 0·50, CI 93, SL 0·38, SI 76, PW 0·36, AL 0·62. Maximum diameter of eye 0·12, about 0·24 × HW.

Holotype worker, NEPAL: Tamur R., Dobhan, 1.ii.1962, forest litter (*K. Hyatt*) (BMNH).

Paratype. 1 worker with same data as holotype (MCZ, Cambridge).

A series from BHUTAN: Phuntsholing, 1972, 2/400 m (*Baroni Urbani*) in NM, Basle, compares well with the type-series but the individuals are somewhat darker in colour (mid-brown) and in some the propodeal spines are slightly but definitely longer than the metapleural lobes. The metapleural lobes themselves are somewhat more acute than in the types. Despite these (relatively minor) differences I feel sure that this series from Bhutan represents part of the normal variation of *difficile*.

T. difficile shows affinity with *tonganum* but is smaller than that species and has relatively shorter antennal scapes. Also, the pronotal corners in *tonganum* are very broadly rounded, whilst those of *difficile* are more angular (though not sharply so).

Tetramorium infraspinum Forel
(Fig. 55)

Tetramorium infraspinum Forel, 1905 : 14. Holotype worker, JAVA: Tjibodas, iii.1904 (*K. Kraepelin*) (MHN, Geneva) [examined].

WORKER. TL 3·3, HL 0·70, HW 0·62, CI 90, SL 0·48, SI 77, PW 0·50, AL 0·84.

Anterior clypeal margin entire; mandibles striate. Antennal scrobes broad but shallow, extending back well beyond the level of the eye. Maximum diameter of the eye *c.* 0·14. Occipital margin feebly concave in full-face view, the sides of the head more or less straight. Alitrunk convex in profile; propodeum unarmed, with only an obtuse angle separating the sloping dorsum from the declivity. Metapleural lobes long, broadly triangular and very conspicuous. Petiole in profile with anterior and posterior faces roughly parallel, the dorsum feebly convex. In dorsal view petiole subglobular, about as broad as long; postpetiole broader than long. Dorsal surfaces of head, alitrunk and pedicel segments finely reticulate-rugulose, the median clypeal carina more strongly developed than the surrounding sculpture. Head and alitrunk with a fine superficial punctulation between the rugulae. Gaster unsculptured but with some enlarged hair-pits in the basal half. Fine, dense, relatively short hairs abundant on all dorsal surfaces but the antennal scapes and dorsal (outer) surfaces of the middle and hind tibiae only with short, dense, strongly curved hairs, without elongate straight erect or suberect stouter hairs. Colour uniform blackish brown, the appendages mid-brown.

One of the two species of the Indo-Australian region to lack propodeal armament, *infraspinum* is quickly separated from *tenuicrinis*, the other species with unarmed propodeum, by the fact that the antennae are 11-segmented in *tenuicrinis* and the body is mostly unsculptured.

Tetramorium laparum sp. n.

HOLOTYPE WORKER. TL 3·0, HL 0·68, HW 0·64, CI 94, SL 0·52, SI 81, PW 0·46, AL 0·78.

Mandibles striate; anterior clypeal margin entire, the median portion with an anterior narrow, translucent flange or apron. Frontal carinae weak but quite distinctive, being more strongly developed than the other cephalic sculpture, reaching back well beyond the eyes but occipitally merging into the other sculpture. Antennal scrobes feeble, broad but only shallowly impressed. Eyes prominent, their maximum diameter *c.* 0·15, about 0·25 × HW. Occipital margin in full-face view virtually straight, only exceedingly shallowly concave across the width of the head. Pronotal corners in dorsal view broadly rounded. Petiolar spines quite short but longer than metapleural lobes, the spines strongly elevated, acute and feebly upcurved along their length. Metapleural lobes broad, roughly triangular, acute apically. Node of petiole in profile narrowing slightly from base to apex so that the dorsal length is less than the height of the tergal portion of the node. Anterodorsal and posterodorsal angles of node rounded, the anterior peduncle of the petiole feebly downcurved along its length. Petiole node in dorsal view distinctly broader than long. Dorsum of head weakly longitudinally rugulose with some reticulation occipitally but everywhere on the head the dominant sculpture is a fine, dense, blanketing reticulate-punctulation so that the surfaces appear matt and granular. Dorsal alitrunk finely reticulate-rugulose, the spaces filled with dense punctulation which is, however, not as strongly developed as on the head. Petiole node with traces of sculpture but postpetiole and gaster unsculptured. Dorsal surfaces of head and body with numerous erect or

suberect hairs, but antennal scapes and dorsal (outer) surfaces of hind tibiae only with decumbent or appressed pubescence, without longer hairs of any description. Colour uniform yellowish brown.

PARATYPE WORKER. TL 3·0, HL 0·70, HW 0·66, CI 94, SL 0·52, SI 79, PW 0·46, AL 0·80. Maximum diameter of eye *c.* 0·15; as holotype.

Holotype worker, PHILIPPINES: Dumaguete, 28.iv.1948 (*J. W. Chapman*) (MCZ, Cambridge).

Paratype. 1 worker with same data as holotype (BMNH).

The shape of the pedicel segments, lack of long hairs on the legs and scapes and relatively elongate, narrow scapes relate this species to *tonganum* and its allies, but the very distinctive sculpture immediately separates *laparum*.

Apart from the types one other specimen is known; it bears only the data, PHILIPPINES: Los Banos, in house, and is deposited in MCZ, Cambridge.

Tetramorium salvatum Forel
(Fig. 54)

Tetramorium salvatum Forel, 1902a : 235. Syntype workers, INDIA: 'Inde septentrionale' (*Wroughton*) and 'Nord-ouest de l'Himalaya' (*Smithies*) (MHN, Geneva) [examined].

WORKER. TL 2·8–2·9, HL 0·64–0·66, HW 0·58–0·60, CI 90–91, SL 0·46, SI 76–79, PW 0·42–0·44, AL 0·70–0·74 (2 measured).

Anterior clypeal margin entire. Frontal carinae extending back beyond the level of the eyes, forming the dorsal margins of shallow but quite broad scrobes. Frontal carinae divergent to level of eyes then roughly parallel, only diverging very slightly. Eyes of moderate size, *c.* 0·14, about 0·23 × HW. Propodeal spines in profile short and narrow, only slightly longer than the bluntly rounded metapleural lobes. Petiole in profile with a short, stout, straight anterior peduncle. Height of tergal portion of petiole node in profile distinctly greater than the dorsal length of the node, the node itself tending to taper slightly from base to apex. In dorsal view the node of the petiole is slightly broader than long. Dorsum of head with fine longitudinal rugulae which are well spaced out and somewhat irregular; spaces between rugulae with feeble superficial sculpture. Occipital region of head and entire dorsal alitrunk finely reticulate-rugulose. Dorsal surfaces of petiole and postpetiole mostly smooth, with vestigial traces of sculpture in places; gaster smooth and unsculptured. All dorsal surfaces of head and body with numerous elongate fine hairs, but antennal scapes and middle and hind tibiae with only dense, short, decumbent or subdecumbent pubescence, without longer hairs. Colour yellow-brown, the gaster dark brown.

T. salvatum appears to be closely related to *difficile* of Nepal and Bhutan, but the petiolar peduncle is short, stout and straight in *salvatum* and the metapleural lobes are rounded, whereas in *difficile* the peduncle is long, quite slender and downcurved and the metapleural lobes are triangular.

Tetramorium seneb sp. n.

HOLOTYPE WORKER. TL 2·3, HL 0·56, HW 0·54, CI 96, SL 0·36, SI 67, PW 0·40, AL 0·64.

Mandibles striate; anterior clypeal margin entire and the median portion with a narrow anterior flange or apron. Frontal carinae reaching back well beyond the level of the eyes, anteriorly distinctly more strongly developed than the other cephalic sculpture but near the occipital area becoming much weaker and blending in with the sculpture. Antennal scrobes broad, quite shallow but conspicuous. Occipital margin of head concave medially in full-face view. Eyes situated in front of middle of sides, maximum diameter *c.* 0·12, about 0·22 × HW. Pronotal corners bluntly angular in dorsal view, giving a square-shouldered appearance. Propodeal spines long, tapering and acute, much longer than the broadly triangular, acute metapleural lobes. Petiole in profile with a relatively high node, the length of the dorsum less than the height of the tergal portion of the node; postpetiole evenly convex. Node of petiole in dorsal view as long as broad, the node slightly broader behind than in front. Dorsum of head longitudinally irregularly rugulose with few or no cross-meshes, but with a fine ruguloreticulum occipitally. Dorsal alitrunk irregularly reticulate-rugulose, the petiole dorsum with traces of rugulation towards the sides. Postpetiole and gaster unsculptured. All dorsal surfaces of head and body with numerous fine hairs, the majority of which are short, but the antennal scapes and dorsal (outer) tibial surfaces without such hairs, only with dense, short, erect or suberect pubescence. Colour light brown, the appendages yellowish.

PARATYPE WORKERS. As holotype but some show a slight upcurving of the apex of the propodeal spines. Range of dimensions TL 2·1–2·3, HL 0·54–0·56, HW 0·50–0·54, CI 91–96, SL 0·34–0·36, SI 63–71, PW 0·38–0·40, AL 0·62–0·64 (14 measured).

Holotype worker, WEST MALAYSIA: Malaya, Kuala Lumpur, 13.x.1973 (*B. Bolton*) (BMNH).

Paratypes. 14 workers with same data as holotype (BMNH; MCZ, Cambridge; NM, Basle; MHN, Geneva).

The type-series was retrieved from a Berlese funnel extraction of leaf litter taken by the side of a small stream on a densely overgrown embankment.

The specimens mentioned under material examined fit the above description very well but show some variation in colour, ranging from light brown to yellow. CI and SI of these series fall within the range given above but some specimens from Java are slightly larger than the type-series. The combined size-range of the specimens is HL 0·54–0·60, HW 0·52–0·56, SL 0·34–0·40, PW 0·38–0·44, AL 0·62–0·68.

MATERIAL EXAMINED. WEST MALAYSIA: Malaya, Selangor, Kepong Waterworks Reserve (*R. Crozier*); Selangor, Ulu Gombak (*R. Crozier*). JAVA: Kaliurang (*G. Imadate*); Depok (*Dammermann*).

Tetramorium tonganum Mayr
(Fig. 59)

Tetramorium tonganum Mayr, 1870 : 972, 976. Syntype workers, TONGA: Tongtabu (*Godeffroy*) (NM, Vienna) [examined].

Tetramorium magitae Forel, 1911 : 224. Syntype workers, SRI LANKA: Peradiniya, jungle, 2.iii (*Escherich*) (MHN, Geneva) [examined]. **Syn. n.**

WORKER. TL 2·6–3·1, HL 0·62–0·72, HW 0·56–0·64, CI 85–91, SL 0·46–0·54, SI 80–87, PW 0·40–0·48, AL 0·70–0·84 (36 measured).

Mandibles striate; anterior clypeal margin entire and the median portion of the clypeus with a narrow but fairly conspicuous anterior flange or apron. Frontal carinae extending back well beyond the level of the eyes, usually approaching the occipital margin, the carinae themselves not strongly developed but always more conspicuous than any other cephalic sculpture. Scapes relatively long (see SI above), if laid back in the rather shallow scrobes the apex of the scape just fails to reach the occipital corner. Eyes moderate in size, maximum diameter *c.* 0·14–0·16, about 0·24–0·27 × HW. Pronotum in dorsal view with the anterolateral angles broadly rounded. Propodeal spines relatively short, at most only marginally longer than the broadly triangular metapleural lobes, the spines narrow and acute. In some samples the propodeal armament is reduced to a pair of acute triangular teeth. Petiole in profile with an elongate, narrow peduncle anteriorly which in most is downcurved along its length. In some individuals the curvature appears reduced but the ventral surface of the peduncle always passes through a rounded angle before its junction with the node (Fig. 59). Shape of petiole and postpetiole in profile are as shown in Fig. 59; in dorsal view the petiole node subglobular. Dorsum of head predominantly longitudinally rugulose, with few or no cross-meshes before the level of the posterior margins of the eyes; behind this cross-meshes become more conspicuous, and a reticulum is usually present occipitally. Dorsal alitrunk finely reticulate-rugulose. Petiole and postpetiole predominantly smooth, completely unsculptured in some but often with at least traces of sculpture on the petiole, less commonly with traces on postpetiole also. Gaster unsculptured. All dorsal surfaces with numerous fine hairs of varying length but scapes and hind tibiae only with decumbent short pubescence, without erect pilosity of any description. Colour varying from light yellowish brown to mid-brown, often with the gaster somewhat darker than the head and alitrunk.

The distribution of this species in Polynesia has been covered in some detail by Wilson & Taylor (1967) but the range of the species extends from Japan in the north to New Guinea in the south. The east–west distribution is more difficult to ascertain as the species is capable of being transported by human commerce, but it is probably safe to say that Java and Sumba represent the western limits of *tonganum*. The Malayan record noted below was made in the Botanical Gardens of Kuala Lumpur and I suspect that it may represent an introduction. Similarly with the collection from Sri Lanka which makes up the type-series of the synonymous *magitae*.

The closest relative of *tonganum* is certainly the species *difficile* from Nepal and Bhutan, but this is smaller, with relatively shorter antennal scapes. The legs of *difficile* are shorter and the

pronotal corners are more sharply angulate in dorsal view. Also in *difficile* the propodeum is usually armed with only a pair of minute, acute denticles. A second closely related species, *vandalum*, occurs in New Guinea, but this is blackish brown in colour and has erect and suberect pubescence upon the dorsal (outer) hind tibial surface. To some extent *vandalum* may exclude *tonganum* from New Guinea, as collections of the latter species are rare from that island.

MATERIAL EXAMINED. WEST MALAYSIA: Malaya, Kuala Lumpur, Bot. Gdns (*B. Bolton*). JAVA: Bogor (*Dammermann*). SUMBA: Kananggar (*Dammermann*). JAPAN: Ogasahara I. (*M. Tanaka*). PHILIPPINES: Dumaguete (*J. W. Chapman*). NEW GUINEA: Maffin Bay (*E. S. Ross*). BISMARCK ARCHIPELAGO: no loc. (*Dahl*). SOLOMON IS: Guadalcanal (*E. S. Brown*); Repi I. (*E. S. Brown*); Rennell I. (*J. D. Bradley*); Rendova, Baraboni (*H. T. Pagden*). NEW HEBRIDES: Malekula (*L. E. Cheesman*); Vila Efate (*L. E. Cheesman*); Togabé (*P. Cochereau*). FIJI IS: Suva (*W. M. Wheeler*); Lasema (*W. M. Mann*); Waiyanitu (*W. M. Mann*). WALLIS & FUTUNA IS: several series (*G. Hunt*). SAMOAN IS: Upolu, Vailima (*P. A. Buxton & G. H. Hopkins*); Upolu, Tanumalala (*T. E. Woodward*); Upolu (*E. C. Zimmermann*); Tutuila, Amouli (*E. C. Zimmermann*); Tutuila, Fagatogo (*E. C. Zimmermann*); Tutuila, Pango Pango (*E. C. Zimmermann*); Savaii, Puapua (*N. L. H. Krauss*). SOCIETY IS: Moorea I. (*A. M. Adamson*); Huahine I. (*E. C. Zimmermann*). MARQUESAS IS: Nuka-hiva (*L. E. Cheesman*); Aimoa, Hiva Oa (*Mumford & Adamson*). CAROLINE IS: Yap I. (*J. L. Gressitt*); Truk, Moen I. (*J. L. Gressitt*). TONGA IS: Tongatabu I. (ex coll. F. Smith). GREAT BRITAIN: London, Kew Gardens (*H. Donisthorpe*).

Tetramorium vandalum **sp. n.**

(Fig. 57)

HOLOTYPE WORKER. TL 3·1, HL 0·72, HW 0·64, CI 89, SL 0·58, SI 90, PW 0·50, AL 0·90.

Mandibles striate; anterior clypeal margin entire and convex, the anterior apron or flange narrow and inconspicuous. Frontal carinae extending back beyond the level of the eyes but no more strongly developed than the rugular sculpture of the cephalic dorsum, the carinae fading and becoming inseparable from the remaining cephalic sculpture before reaching the occiput. Impressions of antennal scrobes shallow, only feebly developed. Eyes of moderate size, maximum diameter *c.* 0·14, about 0·22 × HW. Occipital margin shallowly concave in full-face view. Pronotal corners in dorsal view very broadly rounded. Propodeal spines short, about as long as the metapleural lobes, the spines themselves narrow and acute, slightly elevated; metapleural lobes broadly triangular. Petiole in profile with a narrow, downcurved anterior peduncle, the node shaped as in Fig. 57. Petiole node in dorsal view slightly broader than long. Dorsum of head strongly rugulose, the rugulae irregular and meandering, with numerous cross-meshes; occipital region with a disorganized ruguloreticulum. Dorsum of alitrunk reticulate-rugulose. Sides of petiole and postpetiole sculptured and the dorsal surfaces of these segments with traces of sculpture which are better developed on the petiole than the postpetiole. Gaster unsculptured. All dorsal surfaces of head and body with numerous fine hairs of varying length but antennal scapes only with quite dense, short pubescence of about uniform length. Dorsal (outer) surfaces of hind tibiae equipped with a dense coat of short hairs which are erect, suberect or subdecumbent. Colour uniform blackish brown, the appendages pale yellow-brown.

PARATYPE WORKERS. As holotype but showing variation in thickness and length of propodeal spines. In some the spines are slightly longer than the metapleural lobes, in others distinctly shorter. In one specimen the spines are almost as broad basally as they are long, whereas in the others the spines are obviously longer than their basal width. Postpetiole is almost unsculptured in some individuals. Range of dimensions of paratype workers: TL 2·9–3·2, HL 0·68–0·72, HW 0·58–0·64, CI 84–89, SL 0·52–0·58, SI 87–93, PW 0·46–0·52, AL 0·84–0·90 (10 measured). Maximum diameter of eye *c.* 0·13–0·14, about 0·22–0·24 × HW.

Holotype worker, NEW GUINEA: Papua, Wau, 4000 ft, 1.vii.1974, for. litter (*S. Peck*) (MCZ, Cambridge).

Paratypes. 15 workers and 5 dealate females with same data as holotype (MCZ, Cambridge; BMNH; NM, Basle).

Related to *tonganum* and its allies, *vandalum* is separated from them by its dark colour and the presence of standing hairs on the dorsal surfaces of the hind tibiae.

The *simillimum*-group

Antennae with 12 segments. Sting appendage triangular or dentiform. Anterior clypeal margin entire. Frontal carinae reaching back beyond the level of the eyes, usually approaching the occipital region and usually distinct, reduced only in one or two African species. Antennal scrobes feeble to moderate, but generally conspicuous. Petiole node in dorsal view broader than long, even if only slightly so. Gaster not modified as in *mixtum*-group. Propodeal spines short, triangular. Hairs on dorsal alitrunk short, stout, blunt and sparse. Appendages with pubescence which is usually sparse, fine and appressed, never with hairs. Sculpture predominantly of fine rugulae, the spaces between which are packed with dense punctulation, reduced only in some African species.

This group is strictly African in origin and all its component species appear to be restricted to that continent except for *simillimum*, which is a very successful pantropical tramp species. At the present time *simillimum* has been recorded from all major land masses and a great number of islands. It is sporadically introduced into the temperate zones but here is only capable of surviving in hothouses or other permanently heated buildings.

The diagnosis of the group given above should be regarded as provisional, as the projected study of the Ethiopian and Malagasy species may require its modification in some aspects.

Tetramorium simillimum (F. Smith)
(Fig. 60)

Myrmica simillima F. Smith, 1851 : 118. Syntype workers, GREAT BRITAIN: England, Dorset (types lost, presumed destroyed) [see note below].

Tetramorium simillimum (F. Smith) Mayr, 1861 : 15, 61.

Tetrogmus caldarius Roger, 1857 : 12. Syntype worker, GERMANY: Prussia 'Ananashause in Rauden' (BMNH) [examined]. [Synonymy by Roger, 1862 : 297.]

Myrmica parallela F. Smith, 1859 : 147. Holotype worker, INDONESIA: Aru Is (*A. R. Wallace*) (UM, Oxford) [examined]. **Syn. n.**

Tetramorium parallelum (F. Smith) Donisthorpe, 1932 : 455.

Tetramorium simillimum subsp. *denticulatum* Forel, 1902a : 235. Holotype worker, INDIA: Barrakpur (*Rothney*) (MHN, Geneva) [examined]. **Syn. n.**

Tetramorium simillimum var. *opacior* Forel, 1913 : 81. Syntype workers, SRI LANKA: Peradeniya (MNHU, Berlin) [examined]. **Syn. n.**

Tetramorium antipodum Wheeler, 1927b : 143. Syntype workers, females, males, NORFOLK I.: 1915 (*A. M. Lea*) (location of types not known) (provisional synonym).

Tetramorium simillimum var. *insulare* Santschi, 1928 : 69. Syntype workers, FIJI Is: Lau, Latei Tonga, 6.ix.24 (*Bryan*); Tuvutha, 11.ix.24 (*Bryan*); Avea, 22.ix.24 (*Bryan*) (NM, Basle) [examined]. [Junior secondary homonym of *Tetramorium insulare* (Menozzi), 1924 : 223.] **Syn. n.**

Wasmannia auropunctata subsp. *brevispinosa* Borgmeier, 1928 : 36, figs 4, 5. Syntype workers, BRAZIL: Cabo Fria, viii.1926 (*T. Borgmeier*) (in Brazil Nat. Mus.). [Synonymy by Borgmeier, 1937 : 240.]

NOTE. Although the types of this species have almost certainly been lost or destroyed at some time in the past (they are not in Smith's material at BMNH, nor are they at UM, Oxford), the identity of the species does not appear to have ever been in doubt. It is this traditional interpretation which I take as my basis for defining *simillimum*, and as the species is very widespread and quite well known I can see no obvious reason for designating a neotype.

WORKER. TL 2·1–2·5, HL 0·54–0·60, HW 0·48–0·54, CI 88–93, SL 0·36–0·42, SI 74–80, PW 0·34–0·40, AL 0·58–0·68 (45 measured).

Mandibles finely and usually weakly sculptured, appearing usually as feeble striation or weak shagreening but sometimes more or less dully shining with only superficial sculpture. Anterior clypeal margin entire. Frontal carinae distinct, extending back almost to the occiput and very shallowly, evenly convex along their length. Antennal scrobes broad and quite shallow, but distinct. Eyes moderate in size, maximum diameter *c.* 0·11–0·14, about 0·22–0·26 × HW. Occipital margin in full-face view broadly and shallowly concave, the sides of the head behind the eyes sometimes roughly parallel but usually weakly convex; occipital corners evenly rounded. Propodeum armed with a pair of short, triangular acute teeth which are usually shorter than the metapleural lobes, rarely very slightly longer. Metapleural lobes broad, roughly triangular in shape. Petiole in profile with a stout anterior peduncle, the outline shape of the node as shown in Fig. 60, but in some populations the node tending to narrow very slightly from base to apex. In dorsal view the node always slightly broader than long, somewhat variable in shape but always

broadened posteriorly before narrowing to the postpetiolar junction. Dorsum of head finely and quite densely longitudinally rugulose, the spaces between the rugulae filled with a fine, dense conspicuous reticulate-punctulation or granulation. Area of antennal scrobes densely and finely reticulate-punctulate. Dorsal alitrunk finely, often faintly longitudinally rugulose, with traces of reticulation on pronotum, the spaces between the rugulae densely punctulate. Dorsal petiole and postpetiole similarly but less strongly sculptured, the sculpture sometimes reduced but never completely absent, always with traces of punctulation and nearly always with traces of faint rugulation. Sides of alitrunk densely and conspicuously reticulate-punctate. Gaster unsculptured. All dorsal surfaces of head and body with scattered short hairs, generally longer on the gaster than elsewhere. Hairs on alitrunk conspicuous, short, stout and blunt (Fig. 60). Antennal scapes and dorsal (outer) surfaces of hind tibiae only with very short, fine, appressed pubescence. Colour yellow to yellowish brown, usually with the gaster darker brown but some populations uniformly coloured.

T. simillimum is a small, quite common pantropical tramp species of African origin which is also found as an introduction in hothouses and zoological gardens in the temperate zone. A number of related species are known from the Ethiopian region but none of these occurs outside Africa. The distinctive sculpture and short, stout pilosity will differentiate *simillimum* from other species in the regions at present under consideration. The list of material examined is concerned only with the Oriental, Indo-Australian and Australian regions and regions where *simillimum* has been introduced. The African continental records are omitted as the limits of some of its closest relatives have not yet been determined. For its known distribution in South America see Kempf (1972; 1975), in North America see Creighton (1950) and for detailed distribution in Polynesia see Wilson & Taylor (1967).

MATERIAL EXAMINED. SRI LANKA: Yakkala (*K. L. A. Perera*); Peradeniya (*N. K. Jardine*). INDIA: Assam, Gauhat (CIE Coll.); N. Punjab (*M. S. Saini*). SEYCHELLES: Albatross I. (*U. Müller*); Big Sister I. (*U. Müller*). MAURITIUS: (*J. E. M. Brown*); Rose Hill (*R. Mamet*). WEST MALAYSIA: Malaya, Sg. Patani (*G. H. Lowe*). JAVA: Bogor (*B. Bolton*); Tjibodas (*B. Bolton*); Semarang (*L. G. E. Kalshoven*). BORNEO: Moaretra I. (*Mjoberg*). PHILIPPINES: Dumaguete (*J. W. Chapman*). SOLOMON IS: Guadalcanal (*E. S. Brown*); Ontong Java (*E. S. Brown*). NEW GUINEA: Finschafen (*E. S. Ross*); Maffin Bay (*E. S. Ross*). TIMOR: Oenasi (*W. L. Brown*). AUSTRALIA: Cape York, Silver Plains (*Darlington*); Rocky River (*Darlington*). CHRISTMAS I. (no data). HAWAII: Oahu, Honolulu (no data). FIJI IS: Viti Levu (*W. L. Brown*). SOCIETY IS: Tahiti (*L. E. Cheesman*). JAPAN: Ishigaki I. (*M. Tanaka*). GREAT BRITAIN: London, Kew Gardens (*H. Donisthorpe*). AMIRANTE IS: Darras I. (Sladen Trust Exped.). CAPE VERDE IS: Bravo Nova Cintro (*Lindberg*); S. Antão Pombas (*Lindberg*). PRINCIPE IS: (*G. R. Gradwell & D. Snow*). PUERTO RICO: Tres Hermanos (*M. R. Smith*); Mayaguez (*M. R. Smith*). TRINIDAD: Curepe (*J. Noyes*).

Nomen dubium
Tetramorium infraspinosum Karaviev

Tetramorium infraspinosum Karavaiev, 1935 : 104. Holotype worker, VIETNAM (=Cochinchine): Cauda, 10.x.1930, no. 5788 (*K. Davydov*) (location of type not known).

I have not been able to find the holotype and only known worker of this species. The notes below are abstracted from the original description.

WORKER. TL about 2·0. Head 1·16 times longer than broad (i.e. CI *c*. 86). Anterior clypeal margin entire. Occipital margin feebly concave, sides of head parallel, occipital corners moderately rounded. Frontal carinae directed to occipital corners [presumably reaching beyond level of eyes]. Scape failing to reach occiput by 2 × apical width. Eyes moderately large, in front of midlength of head. Propodeal spines triangular, acute, somewhat elevated; in dorsal view about as long as the distance separating them. Metapleural lobes twice as long as spines, triangular and acute. Petiole in profile with node rectangular, in dorsal view the node longer than broad. Postpetiole about 1·5 × broader than petiole in dorsal view. Head and alitrunk sharply and extensively reticulate-rugose. Dorsum of head longitudinally rugose with about 10–11 components, the spaces between them punctate. Alitrunk reticulate-rugose dorsally, punctate laterally. Petiole punctate with some weak rugae, postpetiole coarsely and irregularly longitudinally rugose. Gaster unsculptured. Erect hairs short, moderately developed. Yellow-rust coloured, gaster and appendages paler, yellowish.

The description is very reminiscent of *simillimum* and for some time I had *infraspinosum* listed under the synonymy of that species. Although no single character given in the original description appears to differentiate *infraspinosum* from *simillimum* I am still reticent about taking the final step and formerly synonymizing it, as I feel sure that Karavaiev must have been acquainted with *simillimum*. So for the present I am leaving *infraspinosum* as a nomen dubium, an unsatisfactory state of affairs but one which I am sure can be quickly cleared up if ever the holotype of *infraspinosum* is found.

Australian species

The Australian species of *Tetramorium* have not been monographed previously and all information about them is scattered through the various original descriptions of new forms.

At present 23 species are known to occur in Australia, of which 17 are endemic, including a single endemic species-group of 10 species. The remaining 6 species are either wide-ranging tramp species such as *simillimum*, or are shared with the Indo-Australian region. Of the 23 Australian species 9 are described here as new. Only a single new synonym is recorded and that is of a form given as a variety.

It seems probable that many more species of this genus await discovery in Australia.

As far as New Zealand is concerned, Brown (1958) records only a single established species, *T. grassii* Emery. This is strictly a South African species and has most probably been introduced into New Zealand by human commerce. I do not doubt that *bicarinatum* and *simillimum* will also be found established in New Zealand at some time, but *grassii* is easily distinguished from these as it combines 12-merous antennae with a spatulate sting appendage. This species will be considered in the section of the revision dealing with the Ethiopian region.

Synonymic list of species

(Species shared with other regions marked*)

***striolatum*-group**
- ***capitale*** (McAreavey) **comb. n.**
- ***fuscipes*** (Viehmeyer) **comb. et stat. n.**
- ***impressum*** (Viehmeyer) **comb. n.**
- ***laticephalum* sp. n.**
- ***megalops* sp. n.**
- ***sjostedti*** Forel
- ***spininode* sp. n.**
- ***striolatum*** Viehmeyer
- ***thalidum* sp. n.**
- ***viehmeyeri*** Forel
  - *viehmeyeri* var. *venustus* Wheeler **syn. n.**

***tortuosum*-group**
- ***andrynicum* sp. n.**
- ***confusum* sp. n.**
- ***splendidior*** (Viehmeyer) **comb. et stat. n.**
- ***strictum* sp. n.**
- ***turneri*** Forel

***bicarinatum*-group**
- ****bicarinatum*** (Nylander)
- ****insolens*** (F. Smith)
- ****pacificum*** Mayr
- ****validiusculum*** Emery

***ornatum*-group**
- ***australe* sp. n.**
- ***deceptum* sp. n.**
- ****ornatum*** Emery

***simillimum*-group**
- ****simillimum*** (F. Smith)

Key to Australian species (workers)

1	Antennae with 11 segments	2
–	Antennae with 12 segments	16
2	With the petiole in profile the posterodorsal angle drawn out into a stout, blunt spine (Fig. 62). Basal angles of first gastral tergite with a narrow projecting semi-translucent flange which is continued as a margination down the sides of the basal third of the tergite. (Western Australia, Northern Territories)	***spininode*** (p. 140)
–	With the petiole in profile the posterodorsal angle not projecting as a blunt spine. Basal angles of first gastral tergite without a flange, not marginate down the basal third of the sides of the tergite	3
3	Large species, HW > 1·20	4
–	Smaller species, HW < 1·20, usually much less than this but rarely with HW up to *c.* 1·10	5

4 Mandibles smooth and highly polished, with scattered small pits. Base of first gastral tergite finely reticulate-punctate. Anterior clypeal margin with a deep median notch. Dorsal alitrunk without erect hairs. (Victoria) . . . . ***laticephalum*** (p. 139)

– Mandibles longitudinally striate. Base of first gastral tergite sharply but finely striate, the interstices reticulate-punctate. Anterior clypeal margin without a median notch. Dorsal alitrunk with erect hairs. (N. Western Australia) . . . . ***sjostedti*** (p. 140)

5 Anterior half to two-thirds of median portion of clypeus descending very steeply, almost vertical, this descending portion conspicuously transversely concave. Median clypeal carina absent from descending portion which is unsculptured, the carina present only on the posterior third of the clypeus and the curve where it rounds into the steep anterior section. (Western Australia) . . . . ***viehmeyeri*** (p. 142)

– Anterior half to two-thirds of median portion of clypeus not shaped as above. Median clypeal carina usually running the length of the clypeus or stopping just short of the anterior margin; anterior half of clypeus usually with other sculpture beside the median carina . . . 6

6 Node of petiole in dorsal view transverse and roughly transversely rectangular in shape (Figs 63, 72), distinctly broader than long 7

– Node of petiole in dorsal view not transverse, usually about as long as or longer than broad; in either case the node not roughly transversely rectangular in shape 8

7 Dorsum of petiole and postpetiole densely punctulate with a few longitudinal rugulae. Spaces between rugulae on dorsal alitrunk densely microscopically punctate. (New South Wales) ***capitale*** (p. 136)

– Dorsum of petiole and postpetiole smooth and highly polished or at most the petiole with traces of sculpture at the extreme lateral edges, the centre shining. Spaces between rugulae on dorsal alitrunk shining, at most with very faint superficial reticulation or vestigial punctulation. (New South Wales, Queensland) . . . . ***confusum*** (p. 143)

8 Eyes large and situated well back on the sides of the head (Fig. 61). HW *c.* 0·78, maximum diameter of eye *c.* 0·24 so that ocular diameter at maximum is about 0·32 × HW. (Western Australia) . . . . ***megalops*** (p. 139)

– Eyes smaller and situated at or close to the midlength of the sides of the head. Maximum diameter of eye always less than 0·30 × HW. In larger species where ocular diameter approaches 0·24 the HW is always much greater than 0·85 9

9 Spaces between rugulae on dorsum of head unsculptured or at most with faint, superficial reticulation or puncturation, the surfaces shining. Sides of head between eyes and frontal carinae not reticulate-punctate although some sculpture may be present. Disc of postpetiole usually smooth, rarely sculptured 10

– Spaces between rugulae on dorsum of head completely filled with a dense, very conspicuous reticulate-puncturation, the surfaces matt and generally quite dull. Sides of head between eyes and frontal carinae densely reticulate-punctate, sometimes with other sculpture also. Disc of postpetiole usually completely sculptured, rarely smooth 13

10 Dorsal alitrunk mostly unsculptured and smooth, with only one or two low, very indistinct, almost effaced rugulae. Metanotal groove very strongly impressed, the propodeal dorsum distinctly humped between the groove and the spines (Fig. 67). (Queensland) ***andrynicum*** (p. 143)

– Dorsal alitrunk strongly rugulose or reticulate-rugulose, the sculpture raised and conspicuous. Metanotal groove at most only weakly impressed (Fig. 64) 11

11 Petiole node in dorsal view with the sides flat to feebly concave and the median sections of each side compressed towards one another so that the true dorsum has a pinched-in median section (Fig. 64). (Queensland) . . . . ***strictum*** (p. 144)

– Petiole node in dorsal view with the sides convex and the median sections of each side not compressed towards one another. Dorsum of node narrowest in front, becoming considerably broader posteriorly (Fig. 65) 12

12 Head and alitrunk dark brown to blackish brown. Dorsum of petiole node with an unsculptured, shining median longitudinal strip. Eyes distinctly shorter than the lengths of antennal segments 9 and 10 taken together. (New South Wales, Queensland) . ***turneri*** (p. 145)

– Head and alitrunk bright orange-red. Dorsum of petiole node sculptured, without an unsculptured shining median longitudinal strip. Eyes as long as the lengths of antennal segments 9 and 10 taken together. (New South Wales) . . . . ***splendidior*** (p. 144)

13 With the petiole in profile the dorsal length of the node greater than the height of the tergal portion so that the node appears relatively long and low (Fig. 71). (Victoria, South Australia) . . . . ***striolatum*** (p. 141)

– With the petiole in profile the dorsal length of the node less than the height of the tergal portion so that the node appears relatively high and narrow (Fig. 69) 14

14 Hairs on promesonotum very short, thick and blunt (Fig. 70), many of them strongly expanded toward the apex. (Queensland) . . . . ***thalidum*** (p. 141)

– Hairs on promesonotum long, slender, often acute apically but if blunted they are not expanded apically (Fig. 69) 15

15 Dorsal surface of postpetiole always strongly sculptured with rugulae and dense puncturation. Frontal carinae differentiated only to level of the eyes, behind this they are suppressed or indistinguishable from the surrounding sculpture. Head approximately same colour as alitrunk. (South Australia, New South Wales, Queensland) . . . . . ***impressum*** (p. 138)

– Dorsal surface of postpetiole usually smooth, rarely with faint puncturation. Frontal carinae strongly developed, reaching almost to the occiput. Head always considerably darker in colour than alitrunk. (New South Wales, Queensland) . . . . . . ***fuscipes*** (p. 138)

16 Anterior clypeal margin with the median portion convex and notched or sharply indented medially 17

– Anterior clypeal margin with the median portion entire, not notched or sharply indented medially 20

17 Head and alitrunk yellow or orange-brown, the gaster either darker or lighter in colour than the head and alitrunk 18

– Entire body uniform dark brown to blackish brown 19

18 Mandibles finely and densely striate. Longest hairs projecting dorsally from frontal carinae behind level of antennal insertions shorter than maximum diameter of eye (Fig. 21). Gaster always much darker in colour than head and alitrunk. (Widespread in Australia) ***bicarinatum*** (p. 94)

– Mandibles smooth except for scattered hair-pits. Longest hairs projecting dorsally from frontal carinae behind level of antennal insertions longer than maximum diameter of eye (Fig. 22). Gaster generally lighter in colour than head and alitrunk, only rarely the same or slightly darker (see p. 100) . . . . ***insolens*** (p. 99)

19 Dorsum of head sculptured with sparse but strong, regular longitudinal carinae or rugae, without any cross-meshes except for a few very close to the occiput, but often absent even here. Ground sculpture between carinae on head very inconspicuous or absent, the surfaces smooth. Basigastral costulae absent. (Queensland) . . . . . . ***validiusculum*** (p. 103)

– Dorsum of head sculptured with rather irregular longitudinal rugae with numerous cross-meshes and with a conspicuous rugoreticulum posteriorly. Ground sculpture between rugae on head superficial but fairly obvious. Basigastral costulae generally present, sometimes very weak but rarely absent. (Northern Territory) . . . . . . ***pacificum*** (p. 102)

20 Hairs on dorsal alitrunk sparse, short, stout and blunt apically (Fig. 60). Head and alitrunk (sometimes also gaster) yellow or yellowish brown. (Pantropical tramp species of African origin) . . . . ***simillimum*** (p. 131)

– Hairs on dorsal alitrunk numerous, of varying length, fine and generally acute apically. Head and alitrunk dark brown, dark reddish brown or blackish brown 21

21 Lateral portions of pronotum very coarsely, sometimes irregularly, longitudinally or obliquely sulcate or exceptionally strongly rugose, the remainder of the sides of the alitrunk similarly sculptured, without reticulate-punctate interspaces. Propodeal spines elongate, more than twice longer than the metapleural lobes, downcurved along their length (Fig. 68). (Queensland) . . . . ***australe*** (p. 146)

– Lateral portions of pronotum reticulate-rugose or sides of alitrunk with reticulate-punctate sculpture present, or both. Propodeal spines shorter, distinctly less than twice the length of the metapleural lobes, usually straight or feebly sinuate, only rarely downcurved . . 22

22 Mesopleuron with strong reticulate-punctate sculpture, any rugulae present are shallow and weakly defined. Node of petiole in dorsal view slightly broader than long. Dorsum of head with spaced-out low longitudinal rugulae, the spaces between them with conspicuous reticulate-punctate ground sculpture. (Queensland) . . . . ***deceptum*** (p. 146)

– Mesopleuron coarsely rugose or sulcate, without or only with faint patches of punctulate sculpture. Node of petiole in dorsal view distinctly longer than broad. Dorsum of head with close-packed, sharply defined, high longitudinal rugulae, the spaces between them unsculptured or at most with very faint traces of punctures. (Queensland, New Guinea, Bismarck Archipelago) . . . . ***ornatum*** (p. 107)

The species-groups

Australia has a single endemic species-group (the *striolatum*-group), the remaining four groups represented on the continent being shared with the Indo-Australian and Oriental regions. In the synonymic list of species those shared with these other zoogeographical regions are marked *. As can be seen, all representatives of the *tortuosum*-group in Australia are endemic, as are two of the three species of the *ornatum*-group. The species shared with other regions and the definitions of the groups to which they belong are discussed under the section of this paper dealing with the Oriental and Indo-Australian regions. The discussion of the *ornatum*- and *tortuosum*-groups is also included in that part of the paper because the majority of the species in these groups occur outside Australia.

The *striolatum*-group

Antennae with 11 segments, sting appendage generally spatulate but pennant-shaped or dentiform and acute apically in some species (e.g. *viehmeyeri*, *spininode*). Petiole nodiform and usually distinctly sculptured (weak in *fuscipes*), the postpetiole strongly sculptured in all but *fuscipes*. Base of first gastral tergite usually sculptured but this may be weak or absent in a few species. Mandibles striate except in *laticephalum*. Dorsum of head with rugose or rugulose sculpture, the spaces between the rugae filled with a fine, dense and generally very conspicuous reticulate-punctation.

The 10 species included in this group constitute a relatively loose assemblage of Australian endemic species related to the members of the *tortuosum*-group but generally more densely sculptured. Some of the most strongly specialized species of *Tetramorium* in the regions at present under discussion occur in this group, for example *spininode*, *megalops*, *laticephalum* and *viehmeyeri*. These specialized forms are grouped around a core of relatively less specialized (as regards morphological peculiarities) species which appear to be closely related, this core including *capitale*, *impressum*, *striolatum* and *thalidum*.

Amongst the *Tetramorium* species with 11-segmented antennae the members of this group are much more widely distributed in Australia than those of the *tortuosum*-group which are more or less restricted to New South Wales and Queensland.

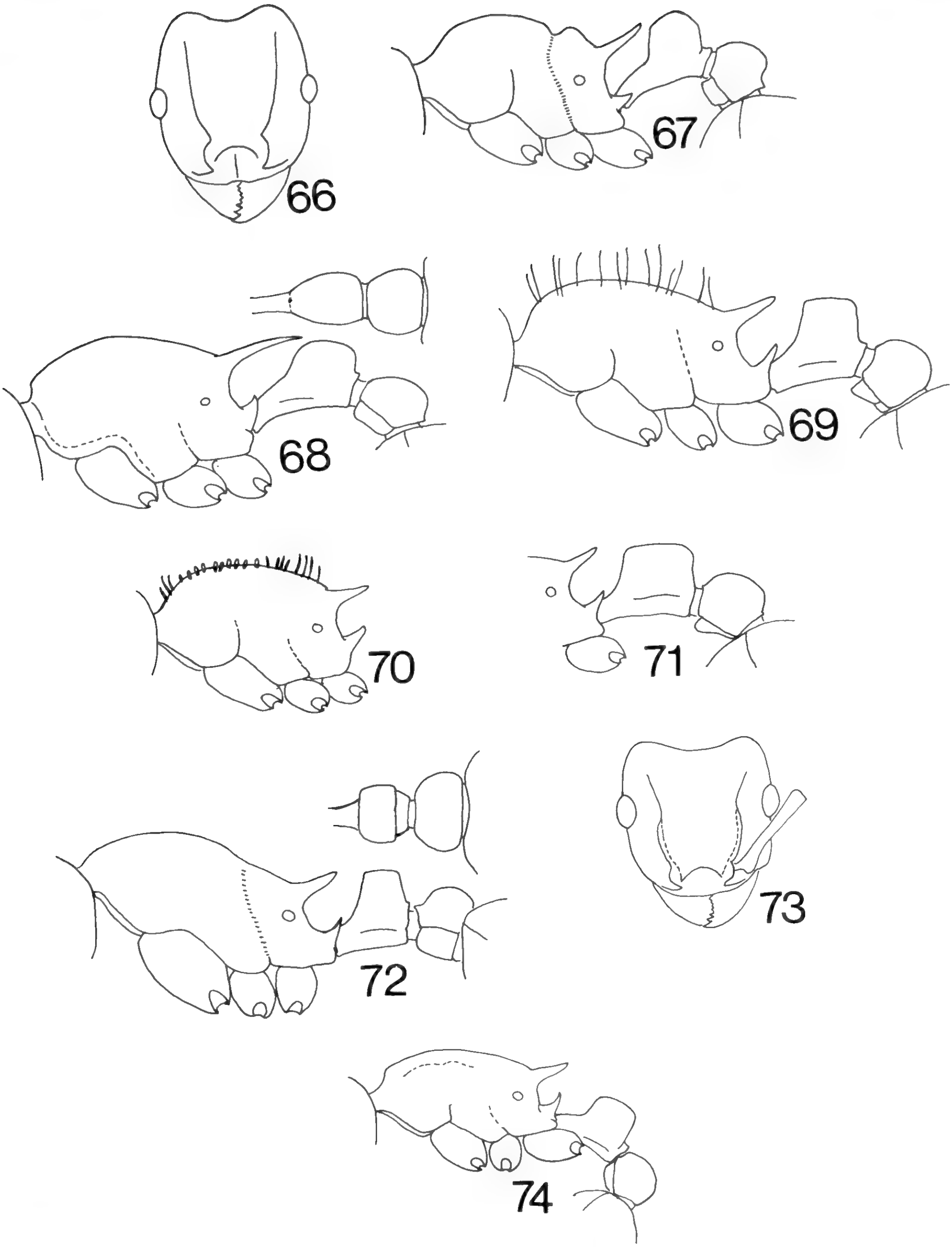
Tetramorium capitale (McAreavey) **comb. n.**
(Fig. 72)

Xiphomyrmex capitalis McAreavey, 1949 : 6, figs 20–25. Holotype worker and paratype workers and females, Australia: New South Wales, Bogan R., Nyngan (*J. W. T. Armstrong*) (ANIC, Canberra) [holotype examined].

Redescription of holotype worker. TL 3·8, HL 0·86, HW 0·82, CI 95, SL 0·60, SI 73, PW 0·72, AL 1·18 (measurements of HW and AL are approximate as specimen is obscured by glue).

Mandibles finely longitudinally striate, the anterior clypeal margin without a median notch. Frontal carinae extending back to level of posterior margin of eye but behind this merging into the other rugulose sculpture of the head. Eyes of moderate size, the maximum diameter *c.* 0·21. Occipital margin of head somewhat concave medially, not 'almost straight' as in the original description. Promesonotum broad and broadly convex both longitudinally and transversely. In profile the promesonotum forming a single convexity and with the propodeum considerably depressed below the level of the promesonotum (Fig. 72) and sloping downwards posteriorly. Propodeal spines acute, metapleural lobes triangular, very narrow apically and somewhat upcurved. Node of petiole in profile with the tergal portion distinctly higher than its dorsal length. In dorsal view the petiole node transverse, distinctly broader than long, with parallel anterior and posterior faces, and the sides slightly divergent posteriorly. Head and dorsal alitrunk predominantly longitudinally rugulose with scattered cross-meshes, the spaces between the rugulae very finely punctulate. Petiole and postpetiole rugulose dorsally and finely, densely punctate; the basal one-third of the first gastral tergite superficially finely punctate. All dorsal surfaces of head and body with numerous erect or suberect hairs. Colour a light orange-brown, with the gaster slightly lighter in shade than the alitrunk and the head considerably darker.

In the original description McAreavey points out that the colour of the type-series is variable. Most specimens are coloured as the holotype but in some individuals he states that the alitrunk and nodes are darker, almost as dark as the head.



Figs 66–74. *Tetramorium* workers. 66. Head of *andrynicum*. 67–72. Alitrunk and pedicel of (67) *andrynicum*, (68) *australe*, (69) *impressum*, (70) *thalidum*, (71) *striolatum*, (72) *capitale*. 73. Head of *sjostedti*. 74. Alitrunk and pedicel of *sjostedti*. Sculpture and pilosity omitted except in 69, 70 where part of pilosity is shown.

Tetramorium fuscipes (Viehmeyer) **comb. et stat. n.**

Xiphomyrmex turneri subsp. *fuscipes* Viehmeyer, 1925 : 29. Syntype workers, AUSTRALIA: New South Wales, Liverpool (NM, Basle) [examined].

NOTE. The published name of this species is as above but the name on the det. label of the syntypes is *fusciceps*, which is more appropriate as the head is dark and is probably the name originally intended by Viehmeyer. However, the above published name must stand, despite the fact that the legs are yellow and not infuscated.

WORKER. TL 2·8–3·1, HL 0·64–0·72, HW 0·58–0·68, CI 90–94, SL 0·44–0·50, SI 72–78, PW 0·46–0·56, AL 0·76–0·88 (10 measured).

Mandibles weakly longitudinally striate, the anterior clypeal margin without a notch medially. Frontal carinae strong and extending back almost to the occiput, forming the dorsal margins of the broad but shallow scrobes. Scrobes as long as the antennal scapes but not deep enough to accommodate them fully. Eyes at the midlength of the sides of the head. Alitrunk in profile with the metanotal groove variously impressed, in most specimens not or only feebly marked but in a few very distinctly impressed. This feature shows much variation in the single nest-series in which it was found (Queensland, Sunnybank). Propodeal spines moderately long, acute; metapleural lobes long, narrow-triangular, acute and feebly upcurved. Petiole in dorsal view at least as long as broad, usually longer than broad. Dorsum of head regularly and quite densely longitudinally rugulose, the spaces between the rugulae packed with a dense, conspicuous reticulate-puncturation. Cephalic rugulae anastomosing or with reticulation on the occipital surface. Dorsal alitrunk reticulate-rugulose, most coarsely so on the pronotum, the spaces filled with puncturation as on the head. Dorsum of petiole unsculptured medially or with a few fine rugulae, the puncturation usually absent; the postpetiole usually smooth and polished, rarely with faint shagreening or puncturation. Gaster smooth and shining. All dorsal surfaces of the head and body with numerous erect to suberect long hairs, those of the alitrunk and pedicel generally blunted apically. Colour yellowish brown, the legs and sometimes also the gaster lighter than the alitrunk. Head always much darker than the remainder, brown to dark brown, this colour contrast distinct to the naked eye.

Although originally described as a subspecies of *turneri* this species is distinct and consistently smaller, lighter in colour and more densely sculptured.

This is one of the Australian species which I suspect may be an aggregate, with two or more sibling species concealed by a mass of variable characters. Variation within *fuscipes* as defined above relates to size, sculpture, impression of metanotal groove, spine length and slight differences in petiole shape. Many of these features do not appear to have any geographical significance (at least not among the few series examined) but one character may be significant, that is the sculpturation, or lack of it, upon the postpetiole. It appears that specimens from the northern end of the range usually have traces of postpetiolar sculpture whilst more southerly samples do not.

MATERIAL EXAMINED. AUSTRALIA: New South Wales, Southerland (*W. M. Wheeler*); N.S.W., Gosford (*W. M. Wheeler*); N.S.W., Hornsby (*W. M. Wheeler*); N.S.W., Leura (*W. M. Wheeler*); Queensland, Cairns (*W. M. Wheeler*); Q., Townsville (*F. P. Dodd*); Q., Brisbane (*W. M. Wheeler*); Q., Sunnybank (*W. M. Wheeler*); Q., Rockhampton (*Darlingtons*).

Tetramorium impressum (Viehmeyer) **comb. n.**
(Fig. 69)

Xiphomyrmex impressus Viehmeyer, 1925 : 30. Holotype worker, AUSTRALIA: New South Wales, Trial Bay (MNHU, Berlin) [examined].

WORKER. TL 2·9–4·1, HL 0·76–1·02, HW 0·72–1·00, CI 92–98, SL 0·52–0·68, SI 69–77, PW 0·54–0·72, AL 0·90–1·22 (15 measured).

Mandibles with varying sculpture, usually weakly striate but more rarely almost smooth. Frontal carinae weak and short, the anterior portion with a narrow, raised flange which extends back to the level of the eyes at most. Behind the level of the eyes the frontal carinae are absent or are in no way separable from the remainder of the cephalic sculpture. Antennal scrobes shallow and very weak or virtually absent, in larger individuals much less distinct than in smaller. Propodeal spines stout and acute, the metapleural lobes acute, elongate-triangular in shape. Petiole in profile relatively high and narrow (Fig. 69), with the dorsal length less than the height of the tergal portion of the node. Dorsal head finely and usually quite regularly longitudinally rugulose, the spaces between rugulae reticulate-punctate. Dorsal alitrunk predominantly longitudinally rugulose but with some cross-meshes, which are usually conspicuous on the

pronotum. Spaces between rugulae punctate. Dorsal surfaces of petiole and postpetiole coarsely sculptured with a mixture of rugosity and puncturation, the base of the first gastral tergite often feebly reticulate or punctulate but smooth in some specimens. All dorsal surfaces of head and body with numerous erect or suberect hairs. Colour ranging from yellow-brown to mid-brown, usually with the gaster lighter in shade than the alitrunk.

This is one species which I strongly suspect may be a composite, with more than one sibling species concealed in it. The variation in size, development of frontal carinae and antennal scrobes, and the variation of sculptural intensity all suggest that this species needs closer attention than I can give it at the present time. The holotype of *impressum* lies at the lower end of the size range given above.

MATERIAL EXAMINED. AUSTRALIA: South Australia, Adelaide (*A. M. Lea*); Victoria, Sea Lake (*J. C. Goudie*); New South Wales, Uralla (*W. M. Wheeler*); Queensland, Kenilworth (*Darlingtons*); Q., W. of Ravenshoe (*Darlingtons*).

Tetramorium laticephalum sp. n.

HOLOTYPE WORKER. TL 4·8, HL 1·26, HW 1·30, CI 103, SL 0·72, SI 55, PW 0·88, AL 1·32.

Mandibles smooth and very shining, with scattered minute pits. Anterior clypeal margin with a conspicuous deep notch or impression medially. Frontal carinae not more strongly developed than other sculpture and indistinguishable from it. Antennal scrobes absent. Maximum diameter of eye *c.* 0·26, moderate for so large a species in that ocular diameter is only 0·20 × HW. Head slightly broader than long, CI > 100. Pronotal corners angular in dorsal view. Propodeal spines stout and acute, the metapleural lobes short-spiniform, about half the length of the propodeal spines. Petiole in dorsal view slightly broader than long and slightly broader behind than in front. Postpetiole distinctly broader than long, in dorsal view roughly hemispherical in outline. In profile the petiole blocky with the surfaces well separated by near right-angles, the postpetiole broadly rounded. Dorsum of head densely and quite finely longitudinally rugulose, the spaces between the rugulae superficially punctulate. Dorsum of alitrunk densely rugose, the rugosity disorganized and the spaces with faint superficial punctures. Petiole and postpetiole rugose, the spaces densely and distinctly punctulate. Basal half of first gastral tergite densely but finely reticulate-punctate. Dorsal surfaces of head, alitrunk, pedicel and first gastral tergite without hairs. Head, alitrunk and pedicel blackish brown to black; gaster, legs, antennae and mandibles clear yellow.

Holotype worker, AUSTRALIA: Victoria, Patho, 1.xi.1943 (*H. A. Potter*) (MCZ, Cambridge).

This large and distinctive species is the only one known from Australia to the present to combine the characters of hairlessness, smooth mandibles, lack of antennal scrobes and very broad head with the 11-segmented antennal condition. It is thus very well characterized and should not be confused with any other species known. Large individuals of *impressum* and *sjostedti* approach the size of *laticephalum* but these have hairs, striate mandibles and generally a head with CI 100 or less.

As only a single specimen of *laticephalum* is known, too much emphasis should not be placed on the difference in alitrunk and gastral colour, which is known to vary in other species (*turneri*, *confusum*), nor in the presence of gastral puncturation which is variable amongst different series of at least one other species (*impressum*).

Tetramorium megalops sp. n.
(Fig. 61)

HOLOTYPE WORKER. TL 4·1, HL 0·90, HW 0·78, CI 87, SL 0·66, SI 84, PW 0·66, AL 1·18.

Mandibles distinctly longitudinally striate; anterior clypeal margin without a median notch. Median clypeal carina absent from anterior (descending) face of clypeus, not reaching anterior margin but fading out just below the clypeal curve. Frontal carinae strong, consisting of a raised, narrow, semitranslucent flange which runs back to the occipital corners where it merges with the sculpture. Scrobe a shallow groove below the carinae capable of partially accommodating the scape. Eyes relatively large, maximum diameter *c.* 0·24, about 0·32 × HW; the eyes situated well back on the sides of the head (Fig. 61). Propodeal spines in profile short (length *c.* 0·16) but acute; metapleural lobes elongate-triangular and acute. Node of petiole in dorsal view slightly longer than broad, broader behind than in front. In profile the

tergal portion of the node is longer than high and the dorsum is very shallowly convex. Postpetiole in profile dome-shaped, as high as the petiole. Dorsum of head longitudinally rugose, with some anastomoses in the occipital region. Sides of head except for scrobe finely reticulate-rugose. Spaces between rugae and area of scrobe finely, densely but distinctly reticulate-punctate. Pronotal dorsum with a fine rugoreticulum but on mesonotum the cross-meshes are reduced so that the sclerite is predominantly longitudinally rugose. Petiole and postpetiole finely reticulate-rugulose everywhere, spaces between rugae on both alitrunk and pedicel filled with dense, fine puncturation. Gaster unsculptured. All dorsal surfaces of body with short, quite stout, blunted hairs. Colour light yellow-brown, the gaster lighter in shade than the head.

Holotype worker, AUSTRALIA: Western Australia, *c.* 60 km NW. Balladonia, 13.ii.1955, no. 440 (*E. O. Wilson & A. Douglas*) (MCZ, Cambridge).

The most conspicuous character of this species is without doubt the eyes, which are both relatively and absolutely large. The maximum eye diameter of 0·24 is approached in general only by species with HW considerably greater than 0·80 so that the maximum diameter is $< 0{\cdot}30 \times$ HW, usually markedly less. The position of the eyes, behind the centre of the sides, may indicate some affinity to *viehmeyeri*, but the unique form of the clypeus will quickly differentiate that species.

Tetramorium sjostedti Forel
(Figs 73, 74)

Tetramorium (*Xiphomyrmex*) *sjöstedti* Forel, 1915 : 48. LECTOTYPE worker, AUSTRALIA: N. Western Australia, Kimberley Distr. (*Mjöberg*) (NR, Stockholm), here designated [examined].

LECTOTYPE WORKER. TL 5·6, HL 1·42, HW 1·34, CI 94, SL 0·92, SI 69, PW 0·94, AL 1·54.

Mandibles longitudinally striate, the anterior clypeal margin without a median notch. Eyes large, maximum diameter *c.* 0·30 (about $0{\cdot}22 \times$ HW), situated slightly behind the midlength of the sides. Frontal carinae strongly developed to just behind the level of the eyes, then fading into the surrounding sculpture. Scapes relatively short and stout, dorsoventrally compressed basally so that in dorsal view the scapes are distinctly broader basally than at their midlength and the anterior margin turns through a sharp angle to meet the basal constriction (Fig. 73). Occipital margin of head strongly impressed. Pronotum and mesonotum marginate laterally, propodeum not marginate. Metanotal groove completely absent, the dorsal alitrunk evenly convex in profile. Anterior pronotal corners acute in dorsal view. Propodeal spines long, stout and acute, the metapleural lobes elongate, acute and directed upwards (Fig. 74). Petiole in profile with the tergal portion higher than the dorsal length, in dorsal view the node very slightly broader than long, broader behind than in front. Entire dorsum of head and space between eyes and frontal carinae regularly and strongly longitudinally rugose, the spaces between the rugae densely reticulate-punctate. Sides and dorsum of alitrunk similarly sculptured, the declivity of the propodeum transversely rugose. Petiole and postpetiole coarsely but less regularly rugose, with some reticulation. Basal half of the first gastral tergite finely longitudinally striate, the spaces between the striae densely punctulate. Long stout hairs present on all dorsal surfaces of head and body.

One of the larger *Tetramorium* species, *sjostedti* is approached in size only by *laticephalum* in the Australian fauna but is easily separated from that species by the characters given in the key. Apparently this rather spectacular species remains known only from the original collection.

Tetramorium spininode sp. n.
(Fig. 62)

HOLOTYPE WORKER. TL 4·3, HL 0·98, HW 0·92, CI 94, SL 0·76, SI 82, PW 0·76, AL 1·32.

Mandibles coarsely striate; anterior clypeal margin straight to very feebly concave medially but without a notch or distinct impression, the median carina extending to the clypeal margin. Frontal carinae elongate and forming the dorsal margins of a narrow and shallow scrobe which is as broad as the scape and which has no defined posterior margin. Eyes moderate, maximum diameter *c.* 0·24. Propodeal spines elongate and acute, the metapleural lobes low and rounded (Fig. 62), not triangular or dentiform. Petiole in profile with the posterodorsal portion of the node drawn out into a broad, blunt, subconical process resembling a thick spine which overhangs the posterior face. Postpetiole in profile with a similar but less well-developed structure, the projecting posterodorsal angle overhanging the posterior face. In dorsal view the petiole longer than broad, broadest at about the midlength, narrowed and truncated anteriorly, more strongly narrowed and narrowly rounded posteriorly at the apex of the prominence. Basal angles of gaster with a narrow, rounded, prominent, semitranslucent flange which goes around the corner on each

side and along the tergite as a carina on each side for about one-third the length of the sclerite, the carina narrowing posteriorly. Head rugose dorsally, the rugae spaced out, predominantly longitudinal but with a number of cross-meshes, especially posteriorly. Spaces between rugae finely and densely punctulate. Alitrunk dorsally predominantly longitudinally rugose but with scattered branches and cross-meshes, most common on the anterior pronotum. Petiole and postpetiole rugose, the spaces between rugae finely punctulate both here and on the alitrunk. Basal half of first gastral tergite densely finely costulate, a few reaching to the posterior margin of the sclerite. Stout, blunted hairs present on all dorsal surfaces of head and body. Head, alitrunk and petiole blackish brown, postpetiole red-brown, gaster and legs yellow.

PARATYPE WORKERS. As holotype, range TL 4·2–4·5, HL 0·94–1·00, HW 0·88–0·94, CI 93–96, SL 0·70–0·76, SI 80–82, PW 0·72–0·78, AL 1·26–1·34 (10 measured). Generally as holotype but the immature workers are much lighter in colour, being approximately the same shade of yellow everywhere. The costulae of the first tergite often fade out on the posterior half of the sclerite.

Holotype worker, AUSTRALIA: Western Australia, Winjana Gorge, 100 m, 17.x.1962 (*E. S. Ross & D. Cavagnaro*) (CAS, San Francisco).

Paratypes. 24 workers, 3 females (2 alate), with same data as holotype (CAS, San Francisco; BMNH; MCZ, Cambridge; NM, Basle).

The most distinctive and spectacular tetramoriine yet described from anywhere in the world, *spininode* cannot be confused with any other species in the tribe. The combination of the uniquely formed petiole node and flanged/carinate base to the first gastral tergite are characteristic and unmistakable and, also, this is one of the few *Tetramorium* species known which combines 11-merous antennae with an acute sting appendage situated apicodorsally on the sting shaft.

Apart from the type-series a single further specimen has been seen from MCZ, Cambridge, collected by C. Barrett at Newcastle Waters, Northern Territory. This specimen agrees with the description but has the head, alitrunk and pedicel segments pale orange-yellow, the gaster and legs yellow.

Tetramorium striolatum Viehmeyer
(Fig. 71)

Tetramorium (*Xiphomyrmex*) *viehmeyeri* var. *striolatus* Viehmeyer, 1913 : 39. Syntype workers, AUSTRALIA: South Australia, Killalpaninna (MNHU, Berlin) [examined].
Xiphomyrmex striolatus (Viehmeyer) Viehmeyer, 1925 : 28. [Raised to species.]

WORKER. TL 3·2–3·7, HL 0·76–0·90, HW 0·70–0·82, CI 91–94, SL 0·54–0·64, SI 73–78, PW 0·54–0·68, AL 0·92–1·08 (10 measured).

Mandibles longitudinally striate, anterior clypeal margin without a notch or impression. Frontal carinae extending back almost to occiput as a narrow raised flange, forming the upper margins of the very feeble, shallow scrobe area. Propodeal spines long, stout and acute, the metapleural lobes narrow, triangular, long and acute. Node of petiole in profile relatively long (Fig. 71), the dorsal length greater than the height of the tergal portion of the node. In dorsal view the node is broader behind than in front and is slightly broader than long. Dorsum of head finely longitudinally rugulose, the spaces between the rugulae finely and densely reticulate-punctate. Dorsal alitrunk densely longitudinally rugulose with some cross-meshes, particularly on the pronotum, the spaces densely punctate. Petiole and postpetiole densely and quite coarsely sculptured with reticulate rugulation and dense puncturation; base of first gastral tergite feebly punctulate or shagreened. All dorsal surfaces of head and body with numerous erect or suberect stout hairs. Colour orange-brown.

This species is closely related to *impressum* but is separated by its longer and more strongly developed frontal carinae and by the shape of the petiole node in profile, compare Figs 69 and 71.

MATERIAL EXAMINED. AUSTRALIA: Victoria, Sea Lake (*J. C. Goudie*).

Tetramorium thalidum **sp. n.**
(Fig. 70)

HOLOTYPE WORKER. TL 3·2, HL 0·80, HW 0·72, CI 90, SL 0·54, SI 75, PW 0·58, AL 0·92.

Mandibles longitudinally striate, median portion of anterior clypeal margin without a notch. Frontal carinae extending back almost to the occiput but becoming indistinguishable from the surrounding sculpture before reaching it. Antennal scrobes long, broad and shallow but their limits clearly defined

and the area which they occupy shallowly concave. Eyes of moderate size, maximum diameter *c.* 0·18, about 0·25 × HW and with a few minute hairs projecting from between the facets (easily abraded away). Eyes situated approximately at the midlength of the sides of the head, the occipital margin very broadly concave. Metanotal groove not impressed, scarcely or not visible in profile. Propodeal spines stout and acute, metapleural lobes elongate, narrowly triangular and feebly upcurved. Node of petiole in profile with anterior and posterior faces parallel and more or less vertical, the dorsal surface evenly, gently convex. Dorsum of head evenly and quite regularly longitudinally rugulose, the spaces between rugulae densely but finely reticulate-punctate. Dorsal alitrunk predominantly longitudinally rugulose with densely punctate spaces except on the pronotum where a rugoreticulum is present. Petiole and postpetiole finely but irregularly rugulose and densely finely punctate. Base of first gastral tergite with fine superficial puncturation or shagreening. All dorsal surfaces of head and body with numerous erect or suberect hairs which are very short, stout and usually blunted on the alitrunk. Colour orange-brown, the head somewhat darker in shade than the remainder.

PARATYPES. As holotype, with dimensions TL 2·9–3·2, HL 0·74–0·80, HW 0·70–0·76, CI 90–95, SL 0·52–0·58, SI 74–77, PW 0·54–0·62, AL 0·90–0·98 (5 measured).

Holotype worker, AUSTRALIA: N. Queensland, Kuranda-Mareeba Rd, Davies Creek, 30.x.1950, dry open forest (*W. L. Brown*) (MCZ, Cambridge).

Paratypes. 5 workers with same data as holotype (MCZ, Cambridge; BMNH).

Tetramorium viehmeyeri Forel

Tetramorium (*Xiphomyrmex*) *viehmeyeri* Forel, 1907 : 275. Holotype female, AUSTRALIA: S. Western Australia, Day Dawn, Stat. 76 (*Michaelsen & Hartmeyer*) (location of type not known).

Xiphomyrmex viehmeyeri var. *venustus* Wheeler, 1934 : 147. Holotype female, AUSTRALIA: Western Australia, Rottnest I., nr Government House, 22.x.1931 (*W. M. Wheeler*) (location of type not known). **Syn. n.**

WORKER. TL 3·5–4·0, HL 0·78–0·90, HW 0·72–0·84, CI 90–93, SL 0·60–0·70, SI 83–86, PW 0·56–0·64, AL 0·92–1·12 (9 measured).

Mandibles striate. Anterior clypeal margin with a distinct median notch or impression. Anterior half to two-thirds of median portion of clypeus descending very steeply, almost vertical, this descending portion conspicuously transversely concave. Median clypeal carina absent from descending portion, short, present on the posterior portion and curve of the clypeus only, sometimes very faint. Frontal carinae with a raised, semi-translucent narrow flange which is distinct to the level of the posterior margins of the eyes, behind this the frontal carinae being scarcely stronger than the other sculpture. Scrobes narrow and shallow, for scape only. Eyes large and strongly convex, the maximum diameter *c.* 0·20–0·24 at HW 0·72–0·84 respectively. Propodeal spines narrow and acute; metapleural lobes triangular, dentiform. Node of petiole in profile angular, the tergal portion about as long as high. In dorsal view the node as broad as or slightly broader than long. Dorsum of head with spaced-out fine longitudinal rugulae, the spaces between them finely and densely reticulate-punctate. Scrobes reticulate-punctate. Dorsal alitrunk with a disorganized rugoreticulum on the pronotum, the constituents of which are sharply defined. Elsewhere on dorsal alitrunk cross-meshes are reduced in number or absent. Petiole and postpetiole finely rugulose, the spaces here and on the alitrunk densely punctulate, but much more conspicuously so on the alitrunk. Gaster smooth or with a very faint shagreening near the base of the first tergite. Hairs numerous on all dorsal surfaces of head and alitrunk, and with shorter subdecumbent hairs on scapes and legs. Colour yellow-brown, the gaster and appendages yellow.

The clypeal structure immediately characterizes this species. As far as I am aware, the only series of workers of this species collected are those mentioned by Wheeler (1934a) the female of which he describes as 'typical', and which form the basis of the above description. This series (in MCZ, Cambridge) lacks the queen which was originally present but the workers match the original description of Forel very well indeed.

MATERIAL EXAMINED. AUSTRALIA: Western Australia, Meekatharra (*W. M. Wheeler*).

The *tortuosum*-group

(For discussion see p. 78.)

Tetramorium andrynicum sp. n.
(Figs 66, 67)

HOLOTYPE WORKER. TL 3·4, HL 0·78, HW 0·68, CI 87, SL 0·64, SI 94, PW 0·52, AL 0·92

Mandibles finely and faintly longitudinally striate. Head in full-face view narrowing behind the eyes, the occipital margin strongly impressed medially (Fig. 66). Eyes small, maximum diameter *c.* 0·16, about 0·23 × HW. Anterior clypeal margin with a shallow median impression. Antennal scrobes feebly developed and shallow, not capable of accommodating the scape, the latter long. Alitrunk in profile with metanotal groove deeply impressed, the dorsum of the propodeum humped between the groove and the bases of the spines (Fig. 67). Propodeal spines long, narrow and acute; metapleural lobes low, triangular and acute. Petiole in profile with dorsum strongly convex (Fig. 67), in dorsal view longer than broad. Dorsum of head weakly sculptured; with median carina distinct and with a strong ruga on each side of the median carina about mid-way between it and the frontal carinae and running back to the level of the posterior margin of the eyes. Apart from this the dorsal head is smooth and shining with only a few feeble, disorganized, meandering and widely scattered rugulae posteriorly. Dorsal alitrunk more weakly sculptured than head, with only traces of feeble, widely spaced rugulae separated by wide smooth, shining areas. Petiole, postpetiole and gaster completely smooth, unsculptured. Hairs numerous on all dorsal surfaces of head and body. Colour dark brown, the appendages yellowish brown.

PARATYPE WORKERS. As holotype, with dimensions TL 3·2–3·3, HL 0·74–0·76, HW 0·66, CI 87–89, SL 0·60–0·64, SI 91–97, PW 0·46–0·50, AL 0·88 (2 measured).

Holotype worker, AUSTRALIA: Queensland, Mt Bartle Frere, W. slope, 3000–5000 ft, xii.1957 (*Darlingtons*) (MCZ, Cambridge).

Paratypes. 2 workers and 2 queens with the same data as holotype (MCZ, Cambridge; BMNH).

The construction of the petiole in this species is remarkably similar to that of *noratum* of Malaysia and Borneo but whether this represents a true relationship or a convergence is not known. I suspect the latter as there are considerable differences in size and sculpture between the two. Amongst the Australian tetramoriines with 11-segmented antennae this species is the least sculptured and has a very conspicuously impressed metanotal groove. These two features combined with the characteristic head-shape noted above should easily differentiate this species from all others in Australia.

Tetramorium confusum sp. n.
(Fig. 63)

HOLOTYPE WORKER. TL 3·4, HL 0·76, HW 0·72, CI 95, SL 0·58, SI 81, PW 0·56, AL 0·92.

Mandibles longitudinally striate; anterior margin of clypeus without a median notch or impression. Frontal carinae extending back almost to the occipital corners and forming the upper margins of the shallow and narrow scrobes. Eyes of moderate size, maximum diameter *c.* 0·20. Median clypeal carina strongly developed, reaching to the anterior margin. With alitrunk in profile the metanotal groove feebly impressed, in dorsal view the track of the fused promesonotal suture faintly visible as a feebly impressed, arched line. Propodeal spines short and acute, metapleural lobes elongate, narrowly triangular and acute. Petiole in profile as in Fig. 63; in dorsal view distinctly broader than long, roughly broadly transversely rectangular but somewhat broader behind than in front. Postpetiole subglobular in dorsal view. Dorsum of head with fine, spaced, irregular longitudinal rugulae, the spaces between which are shining and with a sparse superficial reticulation or vestigial puncturation. Cross-meshes between the rugulae virtually absent. Dorsal alitrunk similarly sculptured but with sharp cross-meshes on the anterior pronotum. Dorsal surfaces of petiole and postpetiole smooth and shining but the former with very faint traces of sculpture at the extreme lateral edges. Gaster unsculptured. Fine erect or suberect hairs present on all dorsal surfaces of head and body but such hairs absent from the appendages where the hairs tend to be short and appressed. Colour dark brown, the appendages somewhat lighter.

PARATYPE WORKERS. TL 3·1–3·5, HL 0·72–0·78, HW 0·66–0·72, CI 89–95, SL 0·54–0·58, SI 78–85, PW 0·52–0·56, AL 0·86–0·94 (10 measured).

Holotype worker, AUSTRALIA: New South Wales, Thegib, nr Bowral, 750 m, 19.xii.1962 (*E. S. Ross & D. Q. Cavagnaro*) (CAS, San Francisco).

Paratypes. 20 workers with same data as holotype (CAS, San Francisco; BMNH; MCZ, Cambridge).

Apart from the type-series, good samples have also been examined from Wentworth Falls and Bulli Pass in New South Wales, and from Kuranda in Queensland. Six specimens from each of these series were measured, including the largest and smallest, and the range was found to be: HL 0·72–0·80, HW 0·66–0·74, CI 90–95, SL 0·52–0·62, SI 80–84, PW 0·52–0·56, AL 0·84–0·96. All fit the above description but the Bulli Pass and Kuranda series have a number of workers in which the gaster is yellow-brown and distinctly lighter than the colour of the head and alitrunk, and in all series the track of the promesonotal suture is by no means as distinctive as in the type-series. A number of workers from several series have more numerous cross-meshes in the dorsal alitrunk sculpture than is seen in the types.

Amongst the known Australian species with 11-merous antennae *confusum* and *capitale* are the only two in which the petiole in dorsal view is distinctly transverse. In *capitale*, however, the petiole and postpetiole are densely punctate with a few longitudinal rugulae and the spaces between rugae on the alitrunk are densely punctate.

MATERIAL EXAMINED. AUSTRALIA: New South Wales, Wentworth Falls (*W. M. Wheeler*); N.S.W., Heathcote (*W. M. Wheeler*); N.S.W., Bulli Pass (*W. M. Wheeler*); N.S.W., Sutherland (*W. M. Wheeler*); N.S.W., Gib Mts (*M. I. Nikitin*); N.S.W., Jenolan Caves (*J. O. Wilson*); N.S.W., Katoomba (*W. M. Wheeler*); N.S.W., Royal National Park (*E. S. Ross & D. Q. Cavagnaro*); Queensland, Kuranda (*W. L. Brown*).

Tetramorium splendidior (Viehmeyer) **comb. et stat. n.**

Xiphomyrmex striolatus subsp. *splendidior* Viehmeyer, 1925 : 29. Holotype worker, AUSTRALIA: New South Wales, Liverpool (MNHU, Berlin) [examined].

WORKER. TL 3·6, HL 0·82, HW 0·74, CI 90, SL 0·60, SI 81, PW 0·60, AL 1·02.

Mandibles finely striate; anterior clypeal margin more or less straight, without a median notch or incision. Median clypeal carina strong, elevated, flanked by a pair of lateral carinae. Frontal carinae extended back as a narrow raised flange to the level of the posterior margins of the eyes, behind this level much weaker, confused with and no more strongly developed than the rugulae in the area. Scrobes weakly developed, consisting of a shallow, narrow groove below the frontal carinae which does not fully accommodate the scape. Eyes moderate, maximum diameter *c*. 0·20. Pronotal corners angulate in dorsal view, metanotal groove feeble, scarcely impressed. Propodeal spines stout and acute; metapleural lobes long and acute. Node of petiole in dorsal view as long as or very slightly longer than broad, narrower in front than behind. Postpetiole subglobular, broader than long. Dorsum of head with a number of spaced rugulae, the gaps between which have faint superficial puncturation. Rugular cross-meshes uncommon on the dorsum, more numerous and distinct in the occipital region and on the sides of the head behind the eyes. Dorsal alitrunk strongly and sharply rugose, the individual rugae raised and acute, predominantly longitudinal on the mesonotum but with strong reticulation on the anterior pronotum. Pedicel segments reticulate-rugose on the sides, the rugae fading out on the postpetiole dorsum so that the disc is predominantly shining with only one or two faint rugulae around its perimeter. Spaces between rugae on alitrunk and pedicel smooth and shining or at most with faint, almost effaced punctulation; gaster smooth, unsculptured. Long, fine hairs present on all dorsal surfaces, the longest on the alitrunk equal to or slightly longer than the maximum diameter of the eye. Colour bright orange-red, the gaster and appendages lighter, yellowish brown.

This species is apparently still known only from the holotype.

Tetramorium strictum **sp. n.**
(Fig. 64)

HOLOTYPE WORKER. TL 3·1, HL 0·78, HW 0·72, CI 92, SL 0·60, SI 83, PW 0·54, AL 0·92.

Mandibles finely longitudinally striate; anterior clypeal margin without a median notch, the strongly developed median carina reaching to the margin. Eyes of moderate size, maximum diameter *c*. 0·16, slightly in front of the midlength of the sides of the head. Frontal carinae extending back almost to the occipital corners, forming the dorsal margin of the weak and shallow scrobes which are about as long as the scape but not deep enough to accommodate it. Metanotal groove broadly but shallowly impressed in profile. Propodeal spines long and strong, the metapleural lobes elongate and narrowly triangular. Petiole in profile with the dorsum rounding into the posterior face, the latter convex and prominent

(Fig. 64). In dorsal view the petiole node longer than broad, only slightly broader behind than in front and narrower apically than at the base so that the dorsum is narrower than the body of the node. Sides of petiole in dorsal view slightly concave (sometimes feebly so) so that the dorsum has a pinched-in or constricted appearance at about its midlength. Dorsum of head with a few widely spaced longitudinal rugulae which anastomose posteriorly, the spaces between them shining and smooth or at most with a very faint trace of sculpture. Dorsal alitrunk with a loose, wide-meshed rugoreticulum, the spaces between which are smooth or have very faint traces of sculpture. Petiole and postpetiole unsculptured dorsally but the former with vestiges of striae on the sides. Gaster unsculptured. All surfaces of head and body with numerous erect hairs. Colour shining mid-brown, the gaster and appendages lighter than the head and alitrunk.

Paratype workers. As holotype, with range TL 3·0–3·2, HL 0·76–0·80, HW 0·70–0·74, CI 92–94, SL 0·58–0·62, SI 80–84, PW 0·52–0·56, AL 0·88–0·94 (8 measured). The ocular diameter shows a range of 0·16–0·18 and in some specimens the dorsal constriction of the petiole is more conspicuous than in the holotype.

Holotype worker, Australia: Queensland, Mt Alexander, NW. Daintree, 20–23.xii.1957, rain forest (*P. F. Darlington*) (MCZ, Cambridge).

Paratypes. 8 workers with same data as holotype (MCZ, Cambridge; BMNH).

Apart from the type-series, specimens from four other series have been examined. Some of these show variation from the types in colour and density of rugulose or rugoreticular sculpture, and in a few the sides of the petiole are more strongly sculptured. Specimens from Rocky River, Cape York, are uniform dark brown and have a sharper and less spaced-out rugoreticulum on the alitrunk. The size range in these specimens is HL 0·72–0·82, HW 0·68–0·76, CI 90–95, SL 0·52–0·62, SI 78–83, PW 0·50–0·60, AL 0·86–1·00, with the range of ocular diameter 0·14–0·18 (10 measured).

All specimens examined have been from rain forest and those from Kuranda bear the information 'rotten log, rain forest'.

Material examined. Australia: Queensland, Cape York, Rocky River (*Darlingtons*); Q., Kuranda v. Cairns (*Darlingtons*); Q., Kirrama Rge v. Cardwell (*Darlingtons*); Q., Kuranda (*W. L. Brown*).

Tetramorium turneri Forel
(Fig. 65)

Tetramorium (*Xiphomyrmex*) *turneri* Forel, 1902c : 447. Syntype workers, female, Australia: Queensland, Mackay (*Turner*) (BMNH; MHN, Geneva) [examined].

Worker. TL 3·2–3·7, HL 0·76–0·86, HW 0·70–0·80, CI 90–95, SL 0·56–0·62, SI 75–82, PW 0·54–0·62, AL 0·90–1·02 (15 measured).

Mandibles striate; anterior clypeal margin without a median notch or impression. Median clypeal carina strong, running to the anterior margin. Frontal carinae extending back almost to the occipital corners but weakening behind the level of the eye and posteriorly not more strongly defined than the rugae occurring in that area. Antennal scrobes shallow and weak, not capable of containing the scape. Eyes situated very slightly in front of midlength of sides of head, of moderate size, maximum diameter *c.* 0·15–0·20. Metanotal groove feebly developed, usually very faintly impressed in profile but rarely quite distinct. In one series (Ravenshoe) some workers have a small triangular prominence mediodorsally on the anterior portion of the propodeum but this is absent in other workers of the same series and in other series examined. Propodeal spines stout and acute, metapleural lobes elongate-triangular and acute, narrow. Petiole node in dorsal view usually slightly longer than broad, the node narrow in front and much broader behind, with slightly convex sides (Fig. 65); postpetiole broader than long. Head longitudinally rugulose, the individual components irregular and spaced out, with few or no anastomoses or cross-meshes, the spaces smooth and shining or with a very faint superficial shagreening or vestigial puncturation. Dorsal alitrunk irregularly and shallowly spaced-rugulose with numerous cross-meshes, the spaces even more feebly sculptured than on the head, very shining. Sides of petiole and postpetiole with some rugosity but the dorsal surfaces either completely smooth or at least with a smooth and highly polished median longitudinal strip. Gaster unsculptured. All dorsal surfaces with numerous long, fine, acute hairs, which are also present on the ventral surfaces of the femora. Colour uniform dark brown or with the gaster a lighter yellowish brown; appendages light to pale brown.

T. turneri, the first tetramoriine to be described from Australia, is apparently more closely related to *eleates* of Malaysia and Indonesia than to any other species of the *tortuosum*-group occurring in Australia itself.

MATERIAL EXAMINED. AUSTRALIA: Queensland, Ravenshoe, Atherton Tab. (*Darlington*); Q., W. of Brisbane (*E. S. Ross & D. Q. Cavagnaro*); Q., Mt Jacob, S. of Gladstone (*Darlingtons*); New South Wales, Coffs Harbour (*W. L. Brown*); Gosford (*W. M. Wheeler*).

The *ornatum*-group

(For discussion see p. 104.)

Tetramorium australe sp. n.
(Fig. 68)

HOLOTYPE WORKER. TL 3·9, HL 0·94, HW 0·90, CI 96, SL 0·76, SI 84, PW 0·64, AL 1·10.

Mandibles striate, anterior clypeal margin convex and entire. Frontal carinae distinct to level of posterior margins of eyes, behind which they are reduced and indistinguishable from the other sculpture. Antennal scrobes very feeble, the area of the scrobe traversed by numerous longitudinal rugae. Eyes situated in front of middle of sides of head, maximum diameter *c.* 0·20. Occipital margin broadly and strongly concave in full-face view, the sides of the head behind the eyes convex. Pronotal corners rounded in dorsal view. Propodeal spines long and narrow in profile, slightly downcurved along their length and over two times longer than the triangular, upcurved metapleural lobes. Peduncle of petiole elongate, feebly downcurved along its length, the node shaped as in Fig. 68. In dorsal view the petiole node longer than broad. Dorsum of head covered with sharp, close-packed, coarse longitudinal rugulae without any cross-meshes, with about 14 longitudinal rugulae between the frontal carinae at the level of the midlength of the eyes. Sides of head between eye and frontal carina similarly sculptured. Dorsal alitrunk very coarsely rugose, the rugae sharp and strongly raised. Sides of pronotum coarsely longitudinally rugose, the same sculpture repeated elsewhere on the lateral alitrunk but less sharply defined. Sides and dorsum of both petiole and postpetiole rugulose, obliquely so on the sides but longitudinally upon the dorsum. Gaster unsculptured. All dorsal surfaces of head and body with numerous fine, erect or suberect hairs of varying length. Antennal scapes and dorsal (outer) surfaces of hind tibiae only with suberect or subdecumbent short hairs. Colour mid-brown, the gaster tending to be darker in shade than the alitrunk.

PARATYPE WORKERS. TL 3·5–4·0, HL 0·86–0·98, HW 0·80–0·92, CI 92–96, SL 0·68–0·78, SI 82–87, PW 0·60–0·66, AL 0·96–1·10 (20 measured). Range of maximum eye diameter 0·16–0·20. Number of longitudinal rugulae between frontal carinae at level of midlength of eye varies from 13 to 15 in paratypes, and some are much darker brown than the holotype.

Holotype worker, AUSTRALIA: Queensland, Cape York, v. Tozer Gap, Jan. 1958, gum forest (*P. F. Darlington*) (MCZ, Cambridge).

Paratypes. AUSTRALIA: 5 workers with same data as holotype; 3 workers with same data as holotype but 'rain forest'; 6 workers, Queensland, Shipton's Flat (S. of Cooktown), June 58, gum forest (*P. F. Darlington*); 6 workers, Queensland, Cape York, Rocky River, early June 58, gum forest (*P. F. Darlington*) (MCZ, Cambridge; BMNH).

This species is closest related to *ornatum*, which also occurs in Cape York. The two species are separated by the characters shown in the key.

Tetramorium deceptum sp. n.

HOLOTYPE WORKER. TL 2·9, HL 0·68, HW 0·64, CI 94, SL 0·48, SI 75, PW 0·48, AL 0·80.

Mandibles striate, anterior clypeal margin entire. Frontal carinae extending back well beyond the level of the eyes but only weakly developed, not stronger than the remaining cephalic sculpture. Antennal scrobes present but only weakly developed. Eyes of moderate size, maximum diameter *c.* 0·14. Occipital margin broadly but shallowly concave in full-face view, the sides of the head behind the eyes feebly convex. Pronotal corners rounded in dorsal view. Dorsal alitrunk evenly but shallowly convex in profile. Propodeal spines short, stout and acute in profile, more or less straight, only fractionally longer than the metapleural lobes; the latter elongate-triangular and upcurved. Petiole in profile with a narrow, weakly downcurved anterior peduncle and a relatively high, blocky node. Dorsal and posterior surfaces of the node meet in a curve which is much less pronounced than the angle separating anterior and dorsal

surfaces; dorsum of node feebly convex in profile. In dorsal view the petiole node is very slightly broader than long, broadest posteriorly. Dorsum of head with numerous longitudinal fine low rugulae, the majority of which are irregular or show some tendency to meander. The spaces between rugulae show a quite conspicuous reticulate-punctate ground sculpture. Dorsal alitrunk sculptured much as head but the rugulae tending to form a weak reticulum on the pronotum and the puncture between them somewhat less conspicuous. Sides of pronotum reticulate-rugulose, the remainder of the sides of the alitrunk with fine longitudinal rugulae and conspicuously reticulate-punctate interspaces. Sides of petiole and post-petiole, and the dorsum of the petiole faintly rugulose with still fainter punctulation, but the postpetiole dorsum tending to be unsculptured at least mediodorsally. Gaster unsculptured. All dorsal surfaces of head and body with numerous fine hairs of varying length but antennal scapes and dorsal (outer) surfaces of hind tibiae only with very short, fine, subdecumbent to decumbent hairs. Colour dark brown, the appendages yellowish brown.

PARATYPE WORKERS. TL 2·8–2·9, HL 0·66–0·68, HW 0·60–0·64, CI 90–94, SL 0·46–0·48, SI 74–80, PW 0·46–0·48, AL 0·78–0·80 (4 measured). Maximum diameter of eye *c.* 0·13–0·14. As holotype but some showing very faint, superficial punctulation mediodorsally on postpetiole.

Holotype worker, AUSTRALIA: Queensland, Shipton's Flat (S. of Cooktown), June 58 (*Darlingtons*) (MCZ, Cambridge).

Paratypes. 4 workers with same data as holotype (MCZ, Cambridge; BMNH).

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British Museum (Natural History)

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A list of the type-specimens of *Ornithoptera* (Lepidoptera : Papilionidae) in the British Museum (Natural History)

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Contents

Synopsis

A detailed list is given of the type-material of 143 species, subspecies and infrasubspecific forms of *Ornithoptera* Boisduval (sensu lato) represented in the collection of the British Museum (Natural History). Six names have been synonymized (*aphnea*, *burkei*, *eudamidas*, *eurysaces*, *phycia*, *sciara*) and one subspecies (*mixtum*) is considered to be a probable feral hybrid.

Introduction

The present work is based on the recent recuration of the Museum's collections of this attractive group of Papilionidae which had not been touched since A. G. Gabriel reorganized the collection some 35 years ago. Since that time the Rothschild and Levick collections have been received and there has been a resurgence of interest in these magnificent insects. Consequently it is felt that a catalogue giving details of the type-material now in the British Museum (Natural History) would be of particular use and interest to students both at home and abroad. The collection is of almost unrivalled size, being housed in nearly 400 large glass-bottomed drawers and containing material examined and described by such authorities as Butler, Druce, Felder, Fruhstorfer, Gray, Rippon, Wallace, Joicey & Talbot and Rothschild & Jordan.

When Lord Rothschild died in 1937 he bequeathed his museum at Tring, Hertfordshire, to the nation. His collection of *Ornithoptera*, apart from being almost as large as that at South Kensington, was immensely rich in type-material for it contained not only the original material described by Walter Rothschild himself but also that of his curator Karl Jordan, who wrote the section devoted to the Indo-Australasian Papilionidae in Seitz's *Macrolepidoptera of the World*. The collection also contained the material collected and described by the Felders of Vienna as well as some of that dealt with by R. H. F. Rippon in his monumental *Icones Ornithopterorum*. Due to its importance scientifically all the Rothschild material has been kept together within the series wherever possible and is labelled 'Rothschild Bequest, B.M.1939–1'.

The Hans Fruhstorfer collection was received by the Museum in 1933 and was another which contained a very great deal of the type-material, almost all of which was described by Fruhstorfer himself. Martin (1922) wrote an interesting obituary of Fruhstorfer and Talbot provided extensive lists of types some seven months after Fruhstorfer's death. As Fruhstorfer was casual and irregular in his labelling of his type-material, which has caused some difficulties to workers in the past, it may help to give some information on this subject. In a letter to the Director of the Hill Museum,

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Witley, Surrey (G. Talbot, J. J. Joicey's curator) in 1919 (Martin, 1922) Fruhstorfer explained that he applied 'type' labels to *all* his specimens – sometimes dozens – up until about 1899, but then realized that this was highly irregular. He then limited his use of his type-labels to only one or two, either male or female or both, for each name. He retained all the original type-material in his own collection and pointed out that specimens labelled 'type' other than in his collection were to be considered 'co-types'. From an examination of his material, apart from labelling his types with a small rectangular 'Type' label printed on red paper, he usually placed a separate manuscript label giving the name of the taxon beneath the type-label on the specimen.

The J. J. Joicey material was acquired in two main batches. The first as a donation in 1931 contained many of his types, the second as a bequest in 1934 comprised the remainder of his collection including paratypic material. Joicey employed George Talbot as his curator and with him was co-author of many papers published in his museum bulletin (*Bull. Hill Mus. Witley*, 1921–1932).

In the past this group of Papilionidae comprising the Bird-wings of the Indo-Australasian region has been divided into one or more genera by various authors. Rothschild (1895) placed all the species in the genus *Troides* Hübner, while Jordan (1908) treated them all as belonging to the omnibus genus *Papilio* L. Rippon (1898–1906) considered *Troides* as a tribe and divided it into five genera consisting of *Ornithoptera* Boisduval, *Schoenbergia* Pagenstecher, *Aetheoptera* Rippon, *Trogonoptera* Rippon and *Pompeoptera* Rippon. Zeuner (1943) divided the *Troides* group into four genera, *Ornithoptera*, *Schoenbergia*, *Trogonoptera* and *Troides*, while Munroe (1961) recognized only two genera, *Troides* and *Ornithoptera*, with *Trogonoptera* as a subgenus of *Troides*. D'Abrera (1975) followed Munroe but raised *Trogonoptera* to generic rank. The same year Haugum & Low (1975) erected a new monobasic genus – *Ripponia* – for the species *hypolitus* Cramer. The present author has followed Zeuner for the most part but has used *Aetheoptera* and *Schoenbergia* as subgenera of *Ornithoptera*.

In this list of 143 entries, which represent approximately 40% of the names applied to the group, the names are arranged alphabetically followed by the author's name and original reference, and the original status and combination in parentheses. The data of the material are then listed exactly as given on the individual labels with a diagonal stroke / between the information given for each label. Finally the current status and combination as considered by the present author is given.

It should be noted that the term syntype is used when the original description was based on more than one specimen and no holotype was selected by the author. Both Rothschild and Jordan and many other authors made little, if any, indication of holotype designation in their descriptions and only labelled their specimens accordingly; consequently where syntypic specimens are present within a series which bear type-labels these are listed first and if lectotype designations be thought necessary at some future date it is suggested that the specimens so-labelled should be selected for this purpose.

Zeuner (1943 : 182, 184) selected lectotypes (holotypes *sic*) from the museum series for four taxa described by Wallace (i.e. *brookiana*, *leda*, *papuensis* and *bouruensis*) but gave no exact indication on the specimens concerned. Where there is only one specimen from the Wallace collection present in the series this has been labelled accordingly with the B.M. type-number mentioned by Zeuner.

List of type-specimens of Ornithoptera

actinotia Jordan, 1908 : 28 (as ♀ form of *Papilio amphrysus flavicollis*). 3 ♀ syntypes. Mt. Marapok, Dent Province, Br. North Borneo (Collector G) / Rothschild Bequest B.M.1939–1. 1 labelled as ♀ f. *actinotia* Jord. Type. in Seitz IX. 1908.
Currently placed as a ♀ form of *Troides amphrysus flavicollis* (Druce).

admiralitatis Rothschild, 1915 : 192 (as subsp. of *Papilio priamus*). 1 ♂, 8 ♀ syntypes. Manus, Admiralty Isl., Sept. Oct. 1913 [Meek's Expedition] / Rothschild Bequest B.M.1939–1. ♂ labelled Type / *Papilio priamus admiralitatis* Rothsch. Type.
Currently placed as a subspecies of *Ornithoptera priamus* (L.).

addenda Fruhstorfer, 1913 : 132 (as ♀ form of *Ornithoptera priamus*). Holotype ♀. Type / Amboina Fruhstorfer / *O. priamus* fa *addenda* Frhst / Fruhstorfer Coll. B.M.1933–131.
Currently placed as a ♀ form of *Ornithoptera priamus priamus* (L.).

aeacus Felder, 1860 : 225 (as sp. of *Ornithoptera*). 1 ♀ syntype. Type / Type of *aeacus* Feld. / Rothschild Bequest B.M.1939–1.
Currently placed as a species of *Troides*.

albescens Rothschild, 1895*b* : 199 (as subsp. of *Troides brookianus*). 10 ♂, 4 ♀ syntypes. 3 ♂ Perak. 1 ♂ Ipoh, Perak (Adams). 1 ♂ Perak III.95. 1 ♂ Perak (Curtis). 1 ♂ Perak, Malacca / Felder Colln. 1 ♂ Malay Pen. (Adams). 2 ♂ Malay Pen. 1 ♀ Perak, Malacca / Felder Colln. / *T. brookianus albescens* Roths / Type 1895 / *albescens* ♀. 1 ♀ Ipoh, Perak (Adams). 1 ♀ Malay Pen. 1 ♀ Malacca (Biggs). All specimens Rothschild Bequest B.M.1939–1.
Currently placed as a subspecies of *Trogonoptera brookiana* (Wallace).
Described from a series of 14 ♂ and 3 ♀. It is apparent that at least 4 ♂ specimens are missing from the syntypic series. These may have been exchanged by Rothschild. Probably one of the ♀ specimens may not be syntypic. The first ♀ listed above and labelled 'type' could be considered for lectotype designation.

alboabdominalis Haugum & Low, 1975 : 117 (as form of *Ripponia hypolitus sulaensis*). 5 ♂ syntypes. 1 ♂ Mangola, Sulla Is. / 777 / Rothschild Bequest B.M.1939–1. 1 ♂ Sula Besi, Oct. 97 (W. Doherty) / Rothschild Bequest B.M.1939–1. 1 ♂ Ulfola. Mangola Sulla. Doh. 10.11.97. / Ulfola Mangola Sulla, Doherty 10.xi.97. Crowley Bequest 1901–78. 2 ♂ Soela Is. W. J. C. Frost 1918 / June, July, Sept. 1918 / Joicey Bequest Brit. Mus. 1934–120.
Currently placed as a ♂ form of *Ripponia hypolitus sulaensis* (Staudinger).

alexandrae Rothschild, 1907 : 96 (as sp. of *Troides*). Holotype ♀. Type / N.E. Coast (inland) B.N.G. (Meek) / *Troides alexandrae* Type. Nov. Zool. 1907. R. / Type of species shot. The only specimen collected on that expedition / Rothschild Bequest B.M.1939–1.
Currently placed as a species of *Ornithoptera* (*Aetheoptera*).

alexisi Le Moult, 1912 : 338 (as aberration of *Ornithoptera victoriae*). 1 ♂ syntype. Nouvelle Guinea, Yule Island. Collection Le Moult / Coll R / *Ornithoptera victoriae* var *Alexisi* nov. var. Co-type E. Le Moult / Joicey Bequest Brit. Mus. 1934–120.
The species is confined to the Solomon Is., therefore the locality given on the data label of this specimen must be presumed erroneous.
Currently placed as an aberration of *Ornithoptera* (*Aetheoptera*) *victoriae* (Gray).

allottei Rothschild, 1914*b* : 275 (as sp. of *Troides*). Holotype ♂. Buin, Bougainville (Abbé Allotte) / *Troides allottei* Roths. Type / Figured by F. E. Zeuner. fig. 54 (genitalia) / Rothschild Bequest B.M. 1939–1. Neallotype ♀ (Peebles & Schmassmann, 1917 : 426). Ex. coll. H. M. Peebles, B.M.1947–203.
Currently placed as a species of *Ornithoptera* (*Aetheoptera*).

amaura Jordan, 1908 : 22 (as ♀ form of *Papilio helena oblongomaculatus*). 1 ♀ syntype. Type / Amboina / ♀ f. *amaura* Type. Jord. in Seitz ix. 1908 / Rothschild Bequest B.M.1939–1.
Currently placed as ♀ form of *Troides oblongomaculatus oblongomaculatus* (Goeze).

androgyna Jordan, 1908 : 19 (as ♀ form of *Papilio criton*). 1 ♀ syntype. Type / Batjan, C. Ribbe 1885 / Figured in Icon. Ornith. / ♀ f. *androgyna* 1908 Jord.-Seitz ix. p. 19 / Rothschild Bequest B.M.1939–1.
Currently placed as a ♀ form of *Troides criton criton* (Felder).

antileuca Rothschild, 1908 : 3 (as subsp. of *Troides helena*). Holotype ♂. Kangean Is. viii. ix. 01. (Prillwitz) / *T. h. antileuca* Type. Roths. Entom. 1908 / Rothschild Bequest B.M.1939–1. Allotype ♀ same data as holotype.
Currently placed as a subspecies of *Troides helena* (L.).

antilochus Fruhstorfer, 1913 : 133 (as subsp. of *Ornithoptera haliphron*). 1 ♂ syntype. Alor Fruhstorfer / Type / *haliphron antilochus* Frhst / Fruhstorfer Coll. B.M.1937–285.
Currently placed as a subspecies of *Troides haliphron* (Boisduval).

antiopa Rothschild, 1908 : 2 (as subsp. of *Troides hypolitus*). 6 ♂ syntypes. Mira, Morty Isl. Nov. 1898 (Dumas) / Rothschild Bequest B.M.1939–1.
Currently placed as a subspecies of *Ripponia hypolitus* (Cramer).

aphnea Jordan, 1908 : 24 (as ♀ form of *Papilio helena heliconoides*). 1 ♀ syntype. Andam Is. / ♀ f. *aphnea* Type Jord. in Seitz ix. 1908 / Rothschild Bequest B.M.1939–1.

There are 3 ♀ specimens labelled Andamans / Andaman / and Pt. Blair. Andamans xii. 4.1.05 which may be syntypes.

Currently placed as a synonym of the nominate ♀ form of *Troides helena heliconoides* (Moore). **Syn. n.**

aplotia Jordan, 1908 : 24 (as ♀ form of *Papilio helena typhaon*). 2 ♀ syntypes. 1 ♀, N. E. Sum., low elev. (Dr. Martin) / ♀ f. *aplotia* Type Jord. in Seitz ix. 1908 / Rothschild Bequest B.M.1939–1. 1 ♀, Selesseh, N. E. Sum., 3.III.93 Dr. Martin / Rothschild Bequest B.M.1939–1.

Currently placed as a ♀ form of *Troides helena typhaon* Rothschild.

arfakensis Joicey & Noakes, 1915 : 362 (as subsp. of *Papilio* (*Troides*) *paradisea*.). 2 ♂, 4 ♀ syntypes. 1 ♂, Angi Lakes, Arfak Mts. 6000 ft. North N. Guinea. March 1914. A. C. & F. Pratt / *O. paradisea arfakensis* J. &. N. ♂ Type / T.E.S. 1916 p. 362 pl. LVIII. fig. 1. / Presented by J. J. Joicey Esq. Brit.Mus. 1931–291. 1 ♂, same data as above but ♂ Co-type. 1 ♀, same data as above but ♀ type. 1 ♀, same data as above but ♀ co-type. 1 ♀, Angi Lakes, Arfak Mts. 6000 ft. North N. Guinea. March 1914. A. C. & F. Pratt. / Joicey Bequest Brit.Mus. 1934–120. 1 ♀ Angi Lakes, Arfak Mts. 6000 ft. Jan-March 1914 / Joicey Bequest Brit.Mus. 1934–120.

Currently placed as a subspecies of *Ornithoptera* (*Schoenbergia*) *paradisea* Staudinger.

argidea Jordan, 1908 : 22 (as ♀ form of *Papilio helena oblongomaculatus*). 3 ♀ syntypes. 1 ♀, Kayeli, Buru III. 97 Doherty / ♀ f. *argidea* Jord. Type in Seitz ix. 1908 / Rothschild Bequest B.M.1939–1. 2 ♀, same data but without type reference.

Currently placed as a ♀ form of *Troides oblongomacalutus bouruensis* (Wallace).

ariadne Rothschild 1908 : 2 (as subsp. of *Troides haliphron*). Holotype ♂. Roma, Aug. '02 (H. Kühn) / *P. h. ariadne* Roths. Type. Entom. 1908 / Rothschild Bequest B.M.1939–1. ♀ Allotype. Roma (H. Kühn) / Rothschild Bequest B.M.1939–1.

Currently placed as a subspecies of *Troides haliphron* (Boisduval).

arruana Felder 1859 : 391 (as sp. of *Ornithoptera*). 1 ♂, 3 ♀ syntypes. 1 ♂, 2 ♀, Aru, Wallace, type / Felder Colln / Rothschild Bequest B.M.1939–1. 1 ♀, Wokam (Aru) / Type / Felder Colln / Rothschild Bequest B.M.1939–1.

There are also 3 ♂ and 1 ♀ from Aru ex Felder collection from the Rothschild collection, two of the males and the female being labelled 'Arru van del Capellen'. All or any of these may be part of the syntypic series.

Currently placed as a subspecies of *Ornithoptera priamus* (L.).

asartia Rothschild, 1908 : 2 (as subsp. of *Troides oblongomaculatus*). 3 ♂ syntypes. 1 ♂, Ceram Laut, 12.xii.99. (H. Kühn)) / *T. h. asartia* Roths. Type Entom. 1908 / Rothschild Bequest B.M.1939–1. 1 ♂, same data as above but without type reference. 1 ♂ Ceram Laut, 13.xii.99 (H. Kühn) / Rothschild Bequest B.M.1939–1.

Rothschild gives the year of capture as 1898.

Currently placed as a subspecies of *Troides oblongomaculatus* (Goeze).

atlas Rothschild, 1908 : 1 (as subsp. of *Troides goliath*.) 2 ♀ syntypes. 1 ♀, Kapaur Low c II.97. Doherty / *goliath atlas* 1908 Roths. Onin Peninsula / *P. goliath titan* Roths. Type Entom. 1908 / *Troides goliath ATLAS* Roth. (not *TITAN* G.-S.) Type. Aug. 4.1951 K. H. Wilson / Rothschild Bequest B.M.1939–1. 1 ♀, Kapaur Low C I.97. Doherty / Rothschild Bequest B.M.1939–1.

Currently placed as a subspecies of *Ornithoptera* (*Schoenbergia*) *goliath* Oberthür.

aurago Fruhstorfer, 1913 : 132 (as form of *Ornithoptera priamus archideus*). 1 ♀ syntype, Waigiu H. Fruhstorfer / type / *archideus* fa *aurago* Frhst. / Fruhstorfer Coll. B.M.1933–131.

Currently placed as a ♀ form of *Ornithoptera priamus poseidon* Doubleday.

azelia Jordan, 1908 : 24 (as ♀ form of *Papilio helena cerberus*). 12 ♀ syntypes. 1 ♀ Coll Marchard type / Refigured and redescribed in Rippon's "Icones Ornithopterorum" / *Pluto* n. / 1 ♀, Cachar, Stoliczka / ♀ *cerberus* Feld. see Rippon's "Icones Ornithopt" / . 1 ♀ Khasia Hills, Assam. 1 ♀, Sikkim Mand / Felder Colln. 1 ♀, Sikkim 10.10.1884, O. Moller. 1 ♀, ♀ var *Cerberus* see Rippon's "Icones Ornithopterorum". 1 ♀, Sikkim May (coll. Hannyngton.). 2 ♀, Sikkim, August (coll. Hannyngton). 1 ♀, Sikkim, F. Hannyngton / ex coll. Hannyngton. 1 ♀, *P. pompeus*, Sikkim / ex coll. Hannyngton. 1 ♀, Darjeeling April (coll. Hannyngton).

These 12 ♀ comprised the Rothschild series of this insect and are all labelled Rothschild Bequest B.M.1939–1 but may not necessarily be syntypic.

Currently placed as a ♀ form of *Troides helena cerberus* (Felder).

bandensis Rothschild, 1908 : 2 (as subsp. of *Troides oblongomaculatus*). 8 ♂, 4 ♀ syntypes. 5 ♂, 4 ♀, Banda. 1 ♂, Gt. Banda 24.ix.98. (H. Kühn). 1 ♂, Gt. Banda 29.ix.98 (H. Kühn). 1 ♂, Gt. Banda 3.x.98 (H. Kühn). All Rothschild Bequest B.M.1939–1.

A homonym of and currently placed as a synonym of *Troides oblongomaculatus bandensis* Pagenstecher (1904).

bazilanicus Fruhstorfer, 1908*a* : 39 (as subsp. of *Troides rhadamantus*). 2 ♂, 2 ♀ syntypes. 1 ♂, Philippinen Bazilan II-III.98 Doherty, ex. coll. Fruhstorfer / Type / *aeacus bazilanicus* Fruhst. / Fruhstorfer Coll. B.M.1937–285. 1 ♂, same data but without type reference ex Adams Bequest B.M.1912–399. 1 ♀, Philippinen Bazilan II-III.98 Doherty ex coll. Fruhstorfer / Type / Fruhstorfer Coll. B.M.1937–285. 1 ♀, same data as second male.

Though Fruhstorfer only listed 2 ♂ and 1 ♀ in his description it seems probable that he was in error in not mentioning the last ♀ listed here.

Currently placed as a subspecies of *Troides rhadamantus* Lucas.

boreas Fruhstorfer, 1901 : 349 (as ab. of *Troides priamus poseidon*). 1 ♀ syntype, Neu-Guinea, Hattam, Arfak ex coll. Fruhstorfer / Type / ab. *boreas* Fruhst. / Fruhstorfer Coll. B.M.1937–285.

Currently placed as an aberration of *Ornithoptera priamus poseidon* Doubleday.

bouruensis Wallace, 1865 : 38 (as a local form of *Ornithoptera helena*). 1 ♂, 2 ♀ syntypes. 1 ♂, Bouru Wallace / Godman-Salvin Coll. 95-5 / *Troides oblongomaculatus bouruensis* Wall. ? ♂ form II det F. Zeuner. / Not figured by F. E. Zeuner. 1 ♀ Boroo 62.87 / Bouru Wallace 62–87 / bouruensis Wallace. 1 ♀ Boroo 62–87 / Bouru Wallace 62–87 / bouruensis Wallace / B—o Wallace / Bouru Wallace / Godman-Salvin Coll. 95–5.

Unfortunately when Zeuner (1943 : 127) made his 'holotype' selection of one of the above females he gave no indication either in his text or on one of the specimens as to which was to be considered his 'holotype' no. Rh. 487. I suggest that the first listed female should be considered for a proper lectotype designation.

Currently placed as a subspecies of *Troides oblongomaculatus* (Goeze).

brookiana Wallace, 1855 : 104 (as sp. of *Ornithoptera*). Lectotype ♂, Sarawak / *brookianus* Wallace / Sarawak, Borneo. Wallace, Godman-Salvin Coll. 95–5 / Rhop. Type No. 489.

Lectotype (holotype *sic*) designated by Zeuner (1943 : 182).

Currently placed as a species of *Trogonoptera*.

brunneus Rothschild, 1895*b* : 189 (as a ♀ ab. of *Troides priamus poseidon*). 1 ♀ syntype, Fergusson I. ix, x, xi, xii, 95 (A. S. Meek) / Type / ab. *brunneus* Type Rothschild. Nov. Zool. 95 / Rothschild Bequest B.M.1939–1.

Currently placed as a ♀ aberration of *Ornithoptera priamus poseidon* Doubleday.

burkei Clark, 1944 : 95 (as subsp. of *Papilio priamus*). 1 ♂, 1 ♀ paratypes. Solomons. Guadalcanal Is. J, C. Burke 1944, B.M.1944–93 / Paratype / Paratype of *Papilio priamus burkei* A.H.C.

Currently placed as a synonym of *Ornithoptera priamus urvillianus* (Guérin-Méneville). **Syn. n.**

caelestis Rothschild, 1898 : 216 (as subsp. of *Troides priamus*). Holotype ♂, 2 ♂, 3 ♀ paratypes. Holotype ♂, St. Aignan, VIII to XI.97 (Meek) / Type / *T. priamus caelestis* Type Rothsch. Nov. Zool. 98. / Rothschild Bequest B.M.1939–1. 2 ♂ paratypes, St. Aignan 1897 (Meek) / Rothschild Bequest B.M.1939–1. 3 ♀ paratypes, same data as holotype but without type reference.

Currently placed as a subspecies of *Ornithoptera priamus* (L.).

capnodia Jordan, 1908 : 22 (as ♀ form of *Papilio helena bouruensis*). 1 ♀ syntype. Kayeli, Buru, Oct. 98 (Dumas) / ♀ f. *capnodia* Type. Jord. in Seitz ix. 1908 / Rothschild Bequest B.M.1939–1.

Currently placed as a synonym of the nominate ♀ form of *Troides oblongomaculatus bouruensis* (Wallace).

carolus Fruhstorfer, 1897 : 306 (as ab. of *Ornithoptera papuensis*). 1 ♂, 1 ♀ syntypes. 1 ♂, Deutzch Neu Guinea / Type / *carolus* Fruhstorfer. Germ. New Guinea. Type / Ex Grose Smith 1910 / Presented by J. J. Joicey Esq. Brit.Mus. 1931–291. 1 ♀, Neu Guinea ex coll. Fruhstorfer. / Type / Fruhstorfer Coll. B.M.1937–285.

Currently placed as an aberration of *Troides oblongomaculatus papuensis* (Wallace).

celebensis Wallace, 1865 : 39 (as local form (subspecies) of *Ornithoptera helena*). 1 ♂ syntype. Macassar / Type / Ex. Grose Smith 1910 / *celebensis* Wall. / Presented by J. J. Joicey Esq. Brit.Mus. 1931–291.

Currently placed as a subspecies of *Troides criton* (Felder).

cellularis Rothschild, 1895 : 202 (as subsp. of *Troides hypolitus*). 2 ♂, 6 ♀ syntypes. 1 ♂, S. Celebes Aug–Sept. '91. W. Doherty / Icones Ornithopter. Vol. II. / Rothschild Bequest B.M.1939–1. 1 ♂, 1 ♀, Talaut Doherty Feb–Maar 1892. 3 ♀, S. Celebes Aug–Sept '91 W. Doherty. 2 ♀ Felder Colln. All ex Rothschild Bequest B.M.1939–1.

Currently placed as a subspecies of *Ripponia hypolitus* (Cramer).

cerberus Felder, 1864 : 19 (as sp. of *Papilio*). 1 ♀ syntype. Type / *Pluto* n. / Coll Marchard type / Refigured and redescribed in Rippon's "Icones Ornithopterorum" / Rothschild Bequest 1939–1.

Currently placed as a subspecies of *Troides helena* (L.)

chimaera Rothschild, 1904*a* : 311 (as sp. of *Troides*). Holotype ♀. Type / Owgarra, north of head of Aroa R., end of May 03 (A. S. Meek) / *Troides chimaera* Type 1904 Nov. Zool. Roths. / Nov. Zool. 1904. Pl. III. FIG 25 / Rothschild Bequest B.M.1939–1. Neallotype ♂. Angabunga R., affl. of St. Joseph R. Brit. N. Guinea 6000 ft. upwards. Nov.04–Febr.05 (A. S. Meek) / Nov. zool. 1906 Pl. III fig. 1. / Rothschild Bequest B.M.1939–1.

There are 3 ♂ and 7 ♀ with the same data as the above ♂ ex Rothschild collection.

Currently placed as a subspecies of *Ornithoptera* (*Schoenbergia*).

chitonia Jordan, 1908 : 21 (as ♀ form of *Papilio plato*). 1 ♀ syntype. Type / Oinainisa, Nov–Dec 1891 W. Doherty / ♀ f. *chitonia* Type Jord. Seitz ix. 1908 / Rothschild Bequest B.M.1939–1.

Currently placed as a ♀ form of *Troides haliphron plato* (Wallace).

chrysophila Rothschild, 1908 : 1 (as ♂ ab. of *Troides priamus arruanus*). Holotype ♂. Type / Aru Is. iv–vii.95. Webster / *P. p. arruanus* ♂ ab. *chrysophila* Type Roths. Entom 1908. / Rothschild Bequest 1939–1.

Currently placed as a ♂ aberration of *Ornithoptera priamus arruana* Felder.

cinna Fruhstorfer, 1908*b* : 50 (as ♀ form of *Troides critonides*). 1 ♀ syntype, Obi, H. Fruhstorfer / *critonides* ♀ ab. *cinna* Fruhst. / Fruhstorfer Coll. B.M.1933–131.

Currently placed as a ♀ form of *Troides criton critonides* (Fruhstorfer).

clara Jordan, 1908 : 19 (as ♀ form of *Papilio criton*). 1 ♀ syntype, Obi major [Waterstradt] / Type / ♀ f. *clara* 1908 Jord. Type. Seitz ix. p. 19. / Rothschild Bequest B.M.1939–1.

Currently placed as a ♀ form of *Troides criton critonides* (Fruhstorfer).

criton Felder, 1860 : 225 (as sp. of *Ornithoptera*) 1 ♂, 1 ♀ syntypes. 1 ♂, Type / Batjan Wallace type / *Pompeoptera criton*, Felder's type ♂ Figured & redescribed in Rippon's 'Icones Ornithopterorum' / Rothschild Bequest B.M.1939–1. 1 ♀ syntype, Type / Batjan, Wallace type / *P. criton* ♀ Felder's type see Icones Ornithopterorum / *criton* n. / ♀ f. felderi 1895 Roths. Nov. Zool. p. 210 / Rothschild Bequest B.M.1939–1.

Currently placed as a species of *Troides*.

critonides Fruhstorfer, 1903*a* : 49 (as subsp. of *Ornithoptera criton*). 1 ♂ syntype. Obi, H. Fruhstorfer / *critonides* Fruhst. / Fruhstorfer Coll. B.M.1933–131.

There are 5 ♂ and 2 ♀ labelled 'Obi. H. Fruhstorfer' ex the Fruhstorfer collection which may possibly be part of a syntypic series. Fruhstorfer described the female but the above mentioned two specimens are labelled '*critonides* ♀ f. *melas* Jord.' and '*critonides* ♀ ab. *cinna* Fruhst' and there is no indication which form represents the nominate though from the description the former may well do so.

Currently placed as a subspecies of *Troides criton* (Felder).

croesus Gray, 1859 : 424 (as sp. of *Papilio* (*Ornithoptera*)). 1 ♂, 1 ♀ syntypes. 1 ♂, Type / 60 92 Batchian / Batchian 60–92 / *croesus* Wallace B. M. Type No. Rhop. 10802 *Papilio* (*O.*) *croesus* ♂ Gray. 1 ♀, same data as ♂. B.M. Type No. Rhop. 10803 *Papilio* (*O.*) *croesus* ♀ Gray.

The determination of the correct authorship of the name *croesus* is likely to remain in doubt. Wallace in a letter to Stevens in Jan. 1859 which was read to the Entomological Society of London on 6.vi.1859 gives a brief description of the male when relating the story of its capture to Stevens and suggested the name '*croesus*' for it. Gray, however, read a paper to the Zoological Society of London in 8.xi.1859 and gave the taxon the name suggested by Wallace when describing both sexes in detail. As Rippon (1898–1906, I : 33) states *croesus* Wallace is little more than a manuscript name. Most authors, however, have been content to follow Rippon and attribute the name to Wallace rather than to Gray.

Currently placed as a species of *Ornithoptera*.

cuneifera Oberthür, 1879 : 110 (as aberration of *Ornithoptera amphrisius*). Holotype ♂. Type / Java / *Amphrisius*, Fabr. aberr. *cuneifera* Oberth ♂ typic specimen / ex coll Ch. Oberthür / Levick Bequest 1941–83.

Currently placed as a species of *Troides*. First raised to specific status by Rippon (1902 : 4).

darsius Gray, 1852 : 5 (as sp. of *Papilio*). 1 ♂ syntype. Type / Specimen Figd. G.D.L. *darsius* Gray ♂ / Ceylon – 45.19 / 1a / B.M. Type No. Rhop. 10811 *Papilio darsius* Gray ♂.
Currently placed as a species of *Troides*.

demophanes Fruhstorfer, 1913 : 131 (as subsp. of *Ornithoptera priamus*). 1 ♀ syntype. Type / Type / Fergusson D'Entrecasteaux Islae ex. coll. Fruhstorfer / Fruhstorfer Coll. B.M.1937–285.
Currently placed as a form of *Ornithoptera priamus poseidon* Doubleday.

diana Jordan, 1908 : 21 (as ♀ form of *Papilio helena hanno*). 1 ♀ syntype. Type / Goram Laut 26.ii.00 (H. Kühn) / ♀ f. *diana* Type Jord. in Seitz IX. 1908 / Rothschild Bequest B.M.1939–1.
Currently placed as a ♀ form of *Troides oblongomaculatus hanno* Fruhstorfer.

divina Fruhstorfer, 1913 : 131 (as ♂ form of *Ornithoptera priamus*). Holotype ♂. Type / Amboina H. Fruhstorfer 16.8.13. / *priamus* fa *divina* Frhst. / Fruhstorfer Coll. 1933–131.
Currently placed as a ♂ form of *Ornithoptera priamus* (L.).

dohertyi Rippon, 1893 : 295 (as sp. of *Ornithoptera* (*Priamoptera*)). 6 ♂, 7 ♀ syntypes. 1 ♂ Type / Talaut, Doherty Feb–Mar 1892 / *O.* (*Pompeoptera*) *Dohertyii* Rippon ♂ Type / Rothschild Bequest B.M.1939–1. 1 ♀ Type / Talaut, Doherty Feb–Mar 1892 (*O.* (*Pompeoptera*) *Dohertyii* Rippon ♀ Type / Rothschild Bequest B.M.1939–1. 5 ♂, 6 ♀ same data but without type reference.
Currently placed as a subspecies of *Troides rhadamantus* (Lucas).

dracaena Joicey & Talbot, 1916*b* : 69, 1922*a* : 320 (as subsp. of *Papilio* (*Troides*) *chimaera*). 3 ♀ syntypes, 1 ♂ neallotype, 3 ♂ paraneallotypes. 1 ♀ syntype, Type / Wandammen Mts. 6000 ft. D. N. Guinea Nov. 1914. A. C. & F. Pratt. / *O. chimaera dracaena* Joicey & Noakes (*sic*) ♀ type / Ann. & Mag. N. H. Ser. 8. Vol. 17. p. 69. pl. V. fig. 7. (Jan. 1916) / Presented by J. J. Joicey Esq. Brit.Mus. 1931–291, 2 ♀, Paratype / Wandammen Mts. 3700 ft. D. N. Guinea Nov. 1914. A. C. & F. Pratt. / *O. chimaera dracaena* subsp. nov. / Joicey Bequest Brit.Mus. 1934–120. 1 ♂ neallotype, Type N. At. / 61–20 Weyland Mtns. Dutch N. Guinea, Dewaro Village 3500 ft., June '20. C. F. & J. Pratt. / *P. chimaera dracaena* J. & T. 1922–320 / 121 *Troides chimaera dracaena* J. &. T. Dutch N. Guinea / Presented by J. J. Joicey Esq. Brit. Mus. 1931–291. 1 ♂ paraneallotype, Paratype / 61.20 Weyland Mtns. Dewaro Vil. 3500 ft. vi. '20. C., F., &. J. Pratt. / Rothschild Bequest B.M.1939–1. 1 ♂ paraneallotype, Paratype / 55–21 Menoo River, 3500–5000 ft. Weyland Mts. Dutch N. Guinea Dec '20–Jan '21. C., F., & J. Pratt. / Joicey Bequest Brit. Mus. 1934–120. 1 paraneallotype, Paratype / 55–21 Mt. Kunupi Menoo Valley, Weyland Mts. 6000 ft. Dutch N. Guinea November 1920 C., F., & J. Pratt. / Joicey Bequest Brit.Mus. 1934–120
Currently placed as a synonym of *Ornithoptera* (*Schoenbergia*) *chimaera charybdis* (Van Eecke).

eudamidas Fruhstorfer, 1913 : 130 (as subsp. of *Ornithoptera priamus*). 5 ♂, 9 ♀ syntypes. 1 ♂, Type / Neu-Guinea, Finsch-Hafen Fruhstorfer / *priamus eudamidas* Frhst. / Fruhstorfer Coll. B.M.1933–131. 1 ♀ Type / Neu-Guinea Finsch-Hafen Fruhstorfer / Fruhstorfer Coll. B.M.1933–131. 4 ♂, 8 ♀ same data but without type reference.
Currently placed as a synonym of *Ornithoptera priamus poseidon* Doubleday. **Syn. n.**

eumaeus Rippon, 1892 : 193 (as sp. of *Ornithoptera*). 1 ♂, 1 ♀ syntypes. / Type / *O. eumaeus* Rippon ♂ Aru Islande / Rothschild Bequest B.M.1939–1. 1 ♀ same data.
Currently placed as a form of *Ornithoptera priamus arruana* Felder.

eumagos Jordan, 1908 : 24 (as ♂ form of *Papilio helena cerberus*). 5 ♂ syntypes. 1 ♂, Assam. 1 ♂ Sikkim April (Coll. Hannyngton). 1 ♂, Tukwar, Sikhim, 4000 ft. May 94 (Bingham). 1 ♂ Sikkim 10.9.1884 O. Moller. 1 ♂, Sikkim. All Rothschild Bequest B.M.1939–1.
Currently placed as a ♂ form of *Troides helena cerberus* (Felder).

euphorion Gray, 1852 : 4 (as sp. of *Papilio*). 1 ♀ syntype. Type / 311c/42–6/6 *Papilio Euphorion* / N. W. Australia 42–6, 311c / *euphorion* Gray / B.M. Type No. Rh.10809 *Papilio euphorion* ♀ Gray.
Currently placed as a subspecies of *Ornithoptera priamus* (L.).

eurysaces Fruhstorfer, 1913 : 131 (as subsp. of *Ornithoptera priamus*). 4 ♂, 2 ♀ syntypes. 1 ♂ Neu-Guinea Milne Bay ex coll. Fruhstorfer / *priamus eurysaces* Frhst. / Fruhstorfer Coll. B.M.1933–131. 3 ♂, 2 ♀ same data but without type reference.
Currently placed as a synonym of *Ornithoptera priamus poseidon* Doubleday. **Syn. n.**

euthycrates Fruhstorfer, 1913 : 134 (as subsp. of *Ornithoptera helena*). 1 ♂, 1 ♀ syntypes. 1 ♂, Type / Tonkin Than–Moi Juni–Juli H. Fruhstorfer / *euthycrates* Frhst / Fruhstorfer Coll. B.M.1933–131. 1 ♀ syntype same data.
Currently placed as a subspecies of *Troides helena* (L.).

euthydemus Fruhstorfer, 1913 : 133 (as subsp. of *Ornithoptera amphrysus*). 9 ♂, 7 ♀ syntypes. 1 ♂, Type / Sumatra, Montes Battak H. Fruhstorfer / *amphrysus euthydemus* Frhst. / Fruhstorfer Coll. B.M.1937–285. 1 ♀, Type / W. Sumatra H. Fruhstorfer / *amphrysus euthydemus* Frhst. / Fruhstorfer Coll. B.M. 1937–285. 6 ♂, 4 ♀ same data as above female, 1 ♀ as first male but without type reference. 1 ♂, 1 ♀ Sumatra Deli, Dr. Martin 1892. 1 ♂, Sumatra, Selok H. Fruhstorfer. All H. Fruhstorfer Coll. B.M.1937–131.

Fruhstorfer records his series as 6 ♂ and 7 ♀ from W. Sumatra and 5 ♀ from NE. Sumatra. From the data of the specimens listed two of the W. Sumatran ♀ specimens are missing, the other listed specimens from Deli and Selok may not belong to the syntypic series.

Currently placed as a synonym of *Troides amphrysus ruficollis* (Butler).

fasciculatus Lathy, 1899 : 147 (as sp. of *Troides*). 2 ♂, 2 ♀ syntypes. 1 ♂, Type / *Troides fasciculatus* Lathy specimen typicum Salibaboo ♂ / Adams Bequest B.M.1912–399 / B.M. Type No. Rh.10823 *Troides fasciculatus* Lathy ♂. 1 ♀ Type / *Troides fasciculatus* Lathy specimen typicum Salibaboo ♀ / Adams Bequest B.M.1912–399 / B.M. Type No. Rh.10825 *Troides fasciculatus* Lathy ♀. 1 ♂ Paratype / *Troides fasciculatus* Lathy Co-type. Salibaboo Adams Bequest B.M.1912–399 / B.M. Type No. Rh.10824 *Troides fasciculatus* Lathy ♂. 1 ♀ same data but B.M. Type No. Rh.10826 *Troides fasciculatus* Lathy ♀.

Currently placed as a form of *Troides rhadamantus dohertyi* (Rippon).

felderi Rothschild, 1895*b* : 210 (as ♀ ab. of *Troides criton*). 1 ♀ syntype. Type / Batjan Wallace type / *criton* n. / *P. criton* ♀ Felder's types see Icones Ornithopterorum ♀ f. *felderi* 1895 Roths. Nov. Zool. p. 210 / Rothschild Bequest B.M.1939–1.

Currently placed as ♀ form of *Troides criton* (Felder).

ferrari Tytler, 1926 : 248 (as sp. of *Troides*). Holotype ♀. Type / Great Nicobar 29.2.24 / *Troides ferrari* Tytler / H. C. Tytler Coll. Brit. Mus. 1941–92. 1 ♀ paratype, Paratype Gt. Nicobar I. Col. M. L. Ferrer / Brit.Mus. 1924–370 / B.M. Type No. Rh.10814 *Troides ferrari* Tytler ♀. Neallotype ♂, Kondul, Nicobars 11.3.27. / H. C. Tytler Coll. Brit. Mus.1941–92.

Currently placed as a subspecies of *Troides helena* (L.).

flavescens Rothschild, 1897 : 180 (as subsp. of *Troides paradiseus*). Holotype ♀. Type / Etna Bay, N.G. viii. Webster 96.8 / 896 / *T. paradiseus flavescens* Type ♀ Rothsch. N.Z.97 / Rothschild Bequest B.M. 1939–1.

Currently placed as a subspecies of *Ornithoptera* (*Schoenbergia*) *paradisea* Staudinger.

flavicollis Druce, 1873 : 356 (as sp. of *Ornithoptera*). 3 ♂, 1 ♀ syntypes. 1 ♂, Type / Godman-Salvin Coll. 95–5. Borneo, Low Ex Druce Coll. / *Ornithoptera flavicollis* Type. H. Druce ♂ / B.M. Type No. Rh. 10819. 1 ♂ Paratype / Godman–Salvin Coll. 95–5 Borneo Low / B.M. Type No. Rh.10821. 1 ♂ same data B.M. Type No. Rh.10822. 1 ♀, same data as first ♂, B.M. Type No. Rh.10820. *Ornithoptera flavicollis* ♀ Druce.

Currently placed as a subspecies of *Troides amphrysus* (Cramer).

flavidior Rothschild, 1913 : 278 (as subsp. of *Troides chimaera*). Holotype ♂. Type / Huon Gulf inland 1200m (Keysser) / *Troides chimaera flavidior* Rothsch. Type 1913 N.z. / Rothschild Bequest B.M.1939–1.

Currently placed as a subspecies of *Ornithoptera* (*Schoenbergia*) *chimaera* (Rothschild).

flavoabdominalis Haugum & Low, 1975 : 117 (as form of *Ripponia* (*T.*) *hypolitus sulaensis*). Holotype ♂. Sula Mangoli, Nov. 97. (W. Doherty) / Icones Ornithop. Vol. II / Rothschild Bequest B.M.1939–1.

Currently placed as a ♂ form of *Ripponia hypolitus* (Cramer).

formosanus Rothschild, 1899 : 67 (as subsp. of *Troides aeacus*). 2 ♂ syntypes. 1 ♂, Type / South Cape, Formosa (De la Touche) / *Tr. aeacus formosanus* Type Rothsch. Nov. Zool. 99. / Rothschild Bequest B.M.1939–1. 1 ♂ same data but without type reference.

Currently placed as a subspecies of *Troides aeacus* (Felder).

goliath Oberthür, 1888 : 1 (as ab. of *Ornithoptera arruana*). Neallotype ♂, (Joicey & Talbot, 1917 : 217). Waigeu April–May 1915 A. C. & F. Pratt / *P. goliath* Ob. Type ♂ (P.T.) Joicey & Talbot / Presented by J. J. Joicey Esq. Brit.Mus. 1931–291.

Currently placed as a species of *Ornithoptera* (*Schoenbergia*).

gypsothelia Jordan, 1908 : 24 (as ♀ form of *Papilio helena cerberus*). 10 ♀ syntypes. 1 ♀ Cachar. 1 ♀ Khasia Hills / Hamilton coll. 1 ♀ Khasia Hills. 1 ♀ Mu Valley, U. Burma 3/94. 1 ♀ Beeling, Tenasserim 30.3.86. 1 ♀ Sikkim June (coll. Hannyngton). 1 ♀ Sikkim 1.5.1885. O. Moller. 1 ♀ Sikkim / Felder Colln. 1 ♀ Sikkim, 20.4.1884, O. Moller. 1 ♀ Sikkim, 6.4.1888, O. Moller. These ten females comprise the Rothschild series of this insect but all may not necessarily be syntypic.

Currently placed as a ♀ form of *Troides helena cerberus* (Felder).

hanno Fruhstorfer, 1904*b* : 27 (as subsp. of *Troides oblongomaculatus*). 6 ♂ syntypes. 1 ♂, Type / Goram Fruhstorfer / *oblongomaculatus hanno* Fruhst. / Fruhstorfer Coll. B.M.1933–131. 1 ♂, Goram Fruhstorfer / *helena hanno* Frhst. / Fruhstorfer Coll. B.M.1933–131. 4 ♂, Goram Fruhstorfer / Fruhstorfer Coll. B.M.1933–131.

Currently placed as a subspecies of *Troides oblongomaculatus* (Goeze).

heliconoides Moore, 1877 : 592 (as sp. of *Ornithoptera*). Holotype ♂. Type / Godman–Salvin Coll. 95–5. Andaman Is. Druce Coll. / *Ornithoptera Heliconoides* ♂ (Type) Moore / B.M.Type N. Rh.10812 *Ornithoptera heliconoides* ♂ Moore. Allotype ♀ same data as holotype B.M. Type No. Rh.10813 *Ornithoptera heliconoides* ♀ Moore.

Currently placed as a subspecies of *Troides helena* (L.).

heptanonius Fruhstorfer, 1913 : 133 (as subsp. of *Ornithoptera haliphron*). 2 ♂, 2 ♀ syntypes. 1 ♂, 1 ♀ Type / Dammer Fruhstorfer / Fruhstorfer Coll. B.M.1933–131. 1 ♂, 1 ♀, Paratype / same data as first pair.

Currently placed as a subspecies of *Troides haliphron* (Boisduval).

honrathiana Martin, 1892 : 492; 1893 : 332 (as sp. of *Ornithoptera*). 1 ♀ syntype, Type / ex Montibus Battak Karo Januar 1893 Malac / Battak Mts. N.E. Sumatra Dr. Martin / ♀ *honrathiana* Type D.L.M. / Rothschild Bequest B.M.1939–1. Neallotype ♂. Same data as ♀ syntype.

Currently placed as a subspecies of *Troides vandepolli* (Snellen).

huebneri Rumbucher, 1973 : 6 (as subsp. of *Schoenbergia goliath*). Holotype ♂. Type H.T. / Goodenough Isl. 2500–4000 ft. March–May 1913, A. S. Meek / Rothschild Bequest B.M.1939–1. 3 ♂, 4 ♀ paratypes, same data as holotype.

Currently placed as a subspecies of *Ornithoptera* (*Schoenbergia*) *goliath* Oberthür.

hycetus Rippon, 1906 : 61 (as sp. of *Pompeoptera*). Holotype ♀. Type H.T. / Java / *Hycetus* Rippon Java Type / Fig. & Descr. in Rippon's "Icon. Ornith" / Ex Grose Smith 1910 / Presented by J. J. Joicey Esq. Brit.Mus. 1931–291.

Currently placed as a ♀ form of *Troides helena helena* (L.).

ikarus Fruhstorfer 1904*a* : 157 (as subsp. of *Troides haliphron*). 1 ♂, 1 ♀ syntypes. 1 ♂, Type / Selaru Fruhstorfer / *ikarus* Fruhst / Fruhstorfer Coll. B.M.1933–131. 1 ♀, Type / Selaru Fruhstorfer / Fruhstorfer Coll. B.M.1933–131.

Currently placed as a subspecies of *Troides haliphron* (Boisduval).

irregularis Dannatt, 1897 : 312 (as sp. of *Ornithoptera* (*Pompeoptera*)). Holotype ♂. Type / *O. irregularis* Type var ? / B.M.1940–130.

Currently placed as an aberration of *Troides oblongomaculatus papuensis* (Wallace).

isabellae Rothschild, 1901 : 401 (as subsp. of *Papilio victoriae*). The syntypic series consisted of 6 ♂, 9 ♀. These were examined by Schmid (1973 : 701) who selected a ♂ and ♀ and designated them as the lectotype and lectoallotype respectively. Lectotype ♂. Isabel I., 4.vi.–9.vii.01 (A. S. Meek) / *Ornithoptera vict. isabellae* Roth. Lectotype ♂ designated by Schmid Can. Ent. 105(6). 1973. / Rothschild Bequest B.M.1939–1. Lectoallotype ♀. Isabel Is. 30.vi.01 (A. S. Meek) / Lectoallotype ♀ *O. victoriae isabellae* Roth. designated by Schmid. 1972 (sic). / Rothschild Bequest 1939–1. 13 paralectotypes. 5 ♂, 1 ♀ as lectotype. 1 ♀ as lectoallotype. 4 ♀, as lectoallotype 6.vii.01.1 ♀ as lectoallotype 25.vi.01. 1 ♀ as lectoallotype 28.vi.01.

Currently placed as a subspecies of *Ornithoptera* (*Aetheoptera*) *victoriae* Gray.

isara Rothschild, 1908 : 3 (as subsp. of *Troides helena*). 7 ♂, 2 ♀ syntypes. 1 ♂ H ili, Madjedja, N. Nias. 4 de trim. '95. I. Z. Kannegaeter. 4 ♂, Gunong Sitoli, Pulo Nias, 1 ♂, Dyma, M. Nias III / V.95. R. Mitschke. 1 ♂ Nias. 2 ♀, Nias. (Raap). All Rothschild Bequest B.M.1939–1.

Currently placed as a subspecies of *Troides helena* (L.).

joiceyi Noakes & Talbot, 1915 : 59 (as sp. of *Ornithoptera*). Holotype ♂. Type H.T. / Angi Lakes, Arfak Mts., 6000 ft. North N. Guinea Jan–Feb 1914 A. C. & F. Pratt. / Ann. Mag. of Nat. Hist. (8)15, 1914 p. 59–61 pl. iv. / Presented by J. J. Joicey Esq. Brit. Mus. 1931–291. Allotype ♀ Type A.T. / same data as holotype. / pl. V. 7 ♂, 3 ♀ paratypes. 4 ♂, 2 ♀, same data as holotype Joicey Bequest Brit.Mus. 1934–120. 3 ♂, 1 ♀ Co-type / Paratype / Same data as holotype ex Levick Bequest B.M.1941–83.

There are also 2 ♂, 2 ♀ from the original series taken by the Pratts ex Rothschild Bequest which may possibly be considered as paratypes or topotypes though they are not labelled as such.

Currently placed as a form of *Ornithoptera* (*Schoenbergia*) *goliath samson* Niepelt.

lavata Fruhstorfer, 1913 : 132 (as form of *Ornithoptera priamus archideus*). 1 ♀ syntype. Type / Waigeu. H. Fruhstorfer / *archideus* fa *lavata* Frhst / Fruhstorfer Coll. 1933–131.
Currently placed as a form of *Ornithoptera priamus poseidon* Doubleday.

leda Wallace, 1865 : 39 (as sp. of *Ornithoptera*). Lectotype ♂. Menado, Celebes. Wallace / Godman–Salvin Coll. 95–5 / Men. / *hephaestus* Feld. / Lectotype (holotype *sic*) designated by Zeuner 1942 : 184. B.M. Type No. Rh.488.
Currently placed as a synonym of *Troides helena hephaestus* (Felder).

lucina Jordan, 1908 : 21 (as ♀ form of *Papilio helena hanno*). 1 ♀ syntype. Type / Goram Laut 28.II.00 (H. Kühn) / ♀ f. *lucina* type Jordan in Seitz ix.1908. Rothschild Bequest B.M.1939–1.
Currently placed as a ♀ form of *Troides oblongomaculatus hanno* Fruhstorfer.

lucinda Jordan, 1908 : 23 (as ♀ form of *Papilio helena hephaestus*). 1 ♀ syntype, Type / Celebes / Celebes Lorquin / *Pompeoptera hephaestus* var ♀ (Felder's subtype) Described and figd in Rippon's Icones Ornithopterorum / ♀ f. *lucinda* Type Jordan in Seitz IX.1908 / Rothschild Bequest B.M.1939–1.
Currently placed as a ♀ form of *Troides helena hephaestus* (Felder).

lydius Felder, 1865 : 9 (as sp. of *Papilio*). 1 ♂, 1 ♀ syntypes. 1 ♂, Type / Gilolo Dod-ga Lorquin / ♂ Felder's type Refigured and described also in Rippon's 'Icones Ornithopterorum' / Rothschild Bequest B.M. 1939–1. 1 ♀, Type / Felder's type ♀ Refigured and described in Rippon's 'Icones Ornithopterorum' / Rothschild Bequest B.M.1939–1.
Currently placed as a subspecies of *Ornithoptera croesus* Gray.

lygaea Jordan, 1908 : 23 (as ♀ form of *Papilio helena hephaestus*). 1 ♀ syntype. Type / Celebes, Lorquin / Felder Colln. ♀ f. *lygaea* Type Jordan in Seitz IX. 1908. / Rothschild Bequest B.M.1939–1.
Currently placed as a ♀ form of *Troides helena hephaestus* (Felder).

macalpinei Moulds, 1974 : 28 (as subsp. of *Ornithoptera priamus*). 1 ♂, 1 ♀ paratypes. ♂ Paratype / Iron Range, N.Qld. 25. May 1974 M. Walford-Huggins / Paratype *Ornithoptera priamus macalpinei* Moulds 1974 / B.M. Rhop. Type No. 18614 / B.M.1975–240. ♀, Paratype / Iron Range, N.Qld. 6 Jan 1964 M. S. Moulds / *Ornithoptera priamus macalpinei* Moulds 1974 / B.M. Type Rh. No. 18615 / B.M.1975–240.
Currently placed as a synonym of *Ornithoptera priamus poseidon* Doubleday.

magellanus Felder, 1862 : 282 (as sp. of *Ornithoptera*). 1 ♀ syntype. Type / Felder Colln. / Felder's type ♀ Refigured and re-described in Rippon's 'Icones Ornithopterorum' / Rothschild Bequest 1939–1.
The ♂ syntype mentioned and figured by Rippon ex Rothschild collection was not present at the time of amalgamation (1975).
Currently placed as a species of *Troides*.

mannus Fruhstorfer, 1908*c* : 238 (as subsp. of *Troides helena*). 2 ♂ syntypes. 1 ♂, Type / Type /Bali viii.06. / *helena mannus* Fruhst / Fruhstorfer Coll. B.M.1937–285. 1 ♂, Paratype / same data as first.
Currently placed as a ♀ form of *Troides helena* (L.).

melas Jordan, 1908 : 19 (as ♀ form of *Papilio criton critonides*). 3 ♀ syntypes. 1 ♀, Type / Obi major (Waterstradt / ♀ f. *melas* Type Jord. in Seitz, 1908, ix. p. 19. / Rothschild Bequest 1939–1. 2 ♀ same data but without type reference.
Currently placed as a ♀ form of *Troides criton critonides* (Fruhstorfer).

melpomona Rippon, 1892 : 46 (as var. of *Pompeoptera helena*). Holotype ♂. Type / N. Guinea / *Pompeoptera papuensis* var *melpomona* Rippon ♂ Type Figured in Icones Ornithop. / Rothschild Bequest B.M.1939–1. Allotype ♀. Same data as holotype.
Currently placed as a synonym of *Troides oblongomaculatus* (Goeze).

meridionalis Rothschild, 1897 : 180 (as subsp. of *Troides paradiseus*). Holotype ♀. Type H.T. / Mailu, Brit. N.Guinea, Anthony leg. July. 95 / *T. paradiseus meridionalis* Type ! Rothsch N.Z.97. / Rothschild Bequest B.M.1939–1. Neallotype ♂ (Rothschild & Jordan, 1899 : 429 [as sp. of *Troides*]. Neallotype / Milne Bay, Brit. N.G., 4.II.99 (A. S. Meek) / Rothschild Bequest B.M.1939–1 / Figured by F. E. Zeuner fig. 49.
Currently placed as a species of *Ornithoptera* (*Schoenbergia*).

miranda Butler, 1869 : 3 (as sp. of *Papilio*). 1 ♂, 1 ♀ syntypes. 1 ♂. Type / 69–28 Sarawak / Sarawak 69–28 / B.M. Type No. Rh.10816 *Papilio miranda* Butl. ♂. 1 ♀. Same data. B.M. Type No. Rh.10817 *Papilio miranda* Butl. ♀.
Currently placed as a species of *Troides*.

misresiana Joicey & Noakes, 1915 : 362 (as subsp. of *Papilio* (*Troides*) *tithonus*). 4 ♀ syntypes. 1 ♀, Type H.T. / Mount Misresi, Arfak Mountains, North New Guinea, 3000 feet. January 1910 C. &. F. Pratt. / *O. tithonus misresiana* Joicey & Noakes ♀ type T.E.S. 1916 p. 362 pl. vii. fig. 7. / Presented by J. J. Joicey Esq. Brit.Mus. 1931–291. 2 ♀, Paratype / same data as first / Joicey Bequest Brit.Mus. 1934–120. 1 ♀, Paratype / same data as first / Rothschild Bequest B.M.1939–1.
Currently placed as a ♀ form of *Ornithoptera* (*Schoenbergia*) *tithonus prominens* (Joicey & Noakes).

mixtum Joicey & Talbot, 1923 : 25 (as form of *Papilio* (*Troides*) *prattorum*). Holotype ♂. Type H.T. / 23–22 Lek Sula (S) Coast, Buru Feb–March 1922. C., F., & J. Pratt / *P. prattorum* f. *mixtum* J. &. T. 23 / 122 *Troides prattorum* f. *mixtum* ♂ Buru J. &. T. / Presented by J. J. Joicey Esq. Brit.Mus. 1931–291.
Currently placed as a probable feral hybrid between *Troides prattorum* (Joicey & Talbot) × *Troides oblongomaculatus bouruensis* (Wallace).

mopa Rothschild, 1908 : 3 (as subsp. of *Troides helena*). Holotype ♀. Type H.T. / Buton I., Dec 1901 (H. Kühn) / *P. h. mopa* Type Roths. Entom. 1098. / Rothschild Bequest B.M.1939–1.
Currently placed as a subspecies of *Troides helena* (L.).

mosychlus Fruhstorfer, 1913 : 134 (as subsp. of *Ornithoptera helena*). 2 ♂, 3 ♀, syntypes. 1 ♂, Type / Nordborneo Brunei Waterstradt 1890 / *mosychlus* Frust / Fruhstorfer Coll. B.M.1937–285. 1 ♀ Type / Nord-Borneo ex coll Fruhstorfer / Fruhstorfer Coll. B.M.1937–285. 1 ♂, 1 ♀ Paratype / Nordborneo Alverett ex coll. Fruhstorfer / Fruhstorfer coll. B.M.1937–285. 1 ♀ same data as first ♀ without type reference.
Currently placed as a subspecies of *Troides helena* (L.).

natunensis Rothschild, 1908 : 1 (as subsp. of *Troides brookiana*). Holotype ♂. Type / Bunguran (Hose) / *brookiana natunensis* Roths. 1908 Natuna Is. / Rothschild Bequest B.M. 1939–1.
Currently placed as a subspecies of *Trogonoptera brookiana* (Wallace).

neomiranda Fruhstorfer, 1903*b* : 57 (as subsp. of *Ornithoptera miranda*). 1 ♂ syntype. Type / Deli district, N.E. Sumatra / *O. neomiranda* Fruhst 1903 Soc. ent. Type ! / *Ornithoptera zacheri* Suffert Ins.–Börse 1903 Type ! / Rothschild Bequest B.M.1939–1.
Currently placed as a subspecies of *Troides miranda* (Butler). It seems possible that this specimen is not a syntype as it was acquired by Rothschild and the Fruhstorfer 'types' were, for the most part, retained by Fruhstorfer himself. It also lacks the Fruhstorfer m.s. type label.

neoris Rothschild, 1908 : 3 (as subsp. of *Troides helena*). Holotype ♂. Type / Binongka, Toekan Bessi Dec 1901 (H. Kühn) / *P. h. neoris* Type Roths. Entom. 1908 / Rothschild Bequest B.M.1939–1. Allotype ♀. Type A.T. same data as holotype.
Currently placed as a subspecies of *Troides helena* (L.).

nephereus Gray, 1856*b* : 6 (as sp. of *Papilio*). 1 ♂ syntype. Type / Philippine Is. 53–77 / B.M. Type No. Rh.10815 *Papilio nephereus* ♂ Gray.
Currently placed as a synonym of *Troides rhadamantus* (Lucas).

nereides Fruhstorfer, 1906*a* : 94 (as subsp. of *Troides helena*). 2 ♂, 3 ♀ syntypes. 1 ♀, Type / Bawean Regenzeit. H. Fruhstorfer / Fruhstorfer Coll. B.M.1933–131. 2 ♂, 2 ♀, same data as first but without type-label.
Currently placed as a subspecies of *Troides helena* (L.).

niasicus Fruhstorfer, 1897 : 306 (as subsp. of *Ornithoptera amphrysus*). 1 ♂, 1 ♀ syntypes, Type / Nias ex coll. Fruhstorfer / *amphrysus niasicus* Fruhst. / Fruhstorfer Coll. B.M.1937–285.
Currently placed as a subspecies of *Troides amphrysus* (Cramer).

nivalis Fruhstorfer, 1913 : 132 (as ♀ form of *Ornithoptera priamus archideus*). 1 ♀ syntype. Type / Type / Waigiu, H. Fruhstorfer / *archideus* fa *nivalis* Frhst / Fruhstorfer Coll. B.M.1933–131.
Currently placed as a ♀ form of *Ornithoptera priamus poseidon* Doubleday.

noellann Rumbucher, 1973 : 10 (as an aberration of *Ornithoptera victoriae rubianus*). Holotype ♂. Type H.T. / Ranonga. B. Solomon Is. / Levick Bequest 1941–83.
Currently placed as an aberration of *Ornithoptera* (*Aetheoptera*) *victoriae rubianus* (Rothschild).

nychonia Jordan, 1908 : 21 (as ♀ form of *Papilio plato*). 2 ♀ syntypes. 1 ♀, Type / Oinainisa Nov–Dec 1891 W. Doherty / ♀ f. *nychonia* Type Jord. in Seitz IX.1908. 1 ♀, same data but without type reference.
Currently placed as a ♀ form of *Troides haliphron plato* (Wallace).

nympha Jordan, 1908 : 23 (as ♀ form of *Papilio helena sagittatus*). 5 ♀ syntypes. 1 ♀, Type / Lombok, Sapit 2000′ April 1896 H. Fruhstorfer / Figured / ♀ f. *nympha* Type Jord. in Seitz IX.1908 / Rothschild Bequest B.M.1939–1. 4 ♀ syntypes, same data but with no type reference.
Currently placed as a ♀ form of *Troides helena sagittatus* (Fruhstorfer).

oberthueri Rothschild, 1895*b* : 210 (as ♀ aberration of *Troides criton*). 1 ♀ syntype. Type / Batjan / 341 / ♀ f. *oberthueri* 1895 Roths. Nov. Zool. p. 210. / Rothschild Bequest B.M.1939–1.
Currently placed as a ♀ form of *Troides criton* (Felder).

olympia Honrath, 1891 : 241 (as sp. of *Ornithoptera*). Holotype ♀. Type / H / Specimen typicum / B.M. Type No. Rh.10827 *Ornithoptera olympia* Honr. / Adams Bequest B.M.1912–399.
Currently placed as a ♀ form of *Troides amphrysus flavicollis* (Druce).

pallens Oberthür, 1897 : 110 (as ♀ ab. of *Ornithoptera haliphron*). 2 ♀ syntypes. 1 ♀, Type / Celebes / *Haliphron* Bdv. aberr ♀ *pallens* Oberthür (typic. specim.) / ex coll. Ch. Oberthür / *O. haliphron* ab. *pallens* ♀ Celebes (Type spc.) / Levick Bequest B.M.1941–83. 1 ♀, *O. pallens* ♀ Salayer Is. near Celebes / ex coll. Ch. Oberthür / *O. pallens* ♀ Sayeler (*sic*) / Levick Bequest B.M.1941–83.
Currently placed as a subspecies of *Troides haliphron* (Boisduval). First raised to subspecific status by Jordan (1908 : 20).

papuensis Wallace, 1865 : 38 (as local form of *Ornithoptera helena*). Lectotype ♂. Salw. Wallace / Salwatty Wallace Godman-Salvin Coll 95–5. [Lectotype (holotype *sic*) designated by Zeuner, 1942 : 184.] B.M. Type No. Rh.487.
Currently placed as a subspecies of *Troides oblongomaculatus* (Goeze).

pegasus Felder, 1864 : 290 (as sp. of *Ornithoptera*). 1 ♂, 2 ♀ syntypes. 1 ♂, N. Guin. occ. Exp. Astria type / Type ♂ Nov. N. / Felder's type also re-figured and re-described in Rippon's 'Icones Ornithopterorum' – *pegasus* / Rothschild Bequest B.M.1939–1. 1 ♀, Type Novara Wuk / Felder's type also re-figured and re-described in Rippon's 'Icones Ornithopterorum' / Rothschild Bequest B.M.1939–1. 1 ♀, N.Guin. occid. Exp. Astria type / N.Gui Wallace type / Rothschild Bequest B.M.1939–1.
Currently placed as a synonym of *Ornithoptera priamus poseidon* Doubleday.

penetia Jordan, 1908 : 23 (as ♀ form of *Papilio helena*). 1 ♀ syntype. Type / Java occident. Sukabumi 2000 1893 H. Fruhstorfer – 3 / ♀ f. *penetia* type Jord. in Seitz IX.1908 / Rothschild Bequest B.M.1939–1.
Currently placed as a ♀ form of *Troides helena* (L.).

phycia Jordan, 1908 : 24 (as ♀ form of *Papilio helena typhaon*). 1 ♀ syntype. Type / N.E.Sum. low elev (Dr. Martin) / ♀ f. *phycia* Type Jord in Seitz IX.1908 / Rothschild Bequest B.M.1939–1.
Currently placed as a synonym of the nominate ♀ form of *Troides helena typhaon* Rothschild. **Syn. n.**

pistor Rothschild, 1896 : 91 (as subsp. of *Troides haliphron*). 5 ♂, 9 ♀ syntypes. 3 ♂, 7 ♀ Kalao, Dec. 95 A. Everett / One of the females is labelled 'Figured in Icones Ornith.' 2 ♂, 2 ♀ Djampea, Dec. 95 A. Everett. All ex Rothschild Bequest B.M.1939–1.
Currently placed as a subspecies of *Troides haliphron* (Boisduval).

ponceleti Rothschild, 1936 : 307 (as ♀ form of *Troides victoriae regis*). Holotype ♀. Type H.T. / Buin, Bougainville 1935 (J. B. Poncelet) / Intersex *ponceleti* Rothsch 1936 Type Ann. Mag. / Rothschild Bequest B.M.1939–1.
Currently placed as a mixed gynandromorph of *Ornithoptera* (*Aetheoptera*) *victoriae regis* (Rothschild).

poseidon Doubleday, 1847 : 173 (as sp. of *Ornithoptera*). 1 ♂ syntype. Type / 2790a / Darnley Is 2790a prc Sq.Ld. Derby / B.M. Type No. Rh.10807 *Ornithoptera poseidon* ♂ Dbl.
Currently placed as a subspecies of *Ornithoptera priamus* (L.).

praecox Fruhstorfer, : 1913 : 134 (as form of *Ornithoptera aeacus*). 2 ♂, 1 ♀, syntypes. 1 ♂, Type / Siam Bangkok January 1901 H. Fruhstorfer / *aeacus* fa *praecox* Frhst / Fruhstorfer Coll. B.M.1933–131. 1 ♀ Type / Siam, Muok-Lek 1000′ Januar H. Fruhstorfer / *aeacus* fa *praecox* Frhst / Fruhstorfer Coll. B.M.1933–131. 1 ♂ same data as female without type reference.
Currently placed as a subspecies of *Troides aeacus* (Felder).

prattorum Joicey & Talbot, 1922*b* : 360 (as sp. of *Papilio* [*Troides*]). Holotype ♂. Type HT / 23–22 West Buru 2–5000 ft. April '22. C. F. & J. Pratt / *Troides prattorum* J. &. T. Type H.T. 1922 / Presented by J. J. Joicey Esq. Brit.Mus. 1931–291. Allotype ♀ – Type A.T. / same data as holotype. 2 ♀ paratypes. Type P.T. / 23.22 West Buru 2–5000 ft. April 1922 C. F. & J. Pratt / Joicey Bequest Brit.Mus. 1934–120.
Currently placed as a species of *Troides*.

procus Rothschild 1914*a* : 262 (as sp. of *Troides*). Holotype ♀. Type / Ceram (E. Stresemann) / *Troides procus* Rothsch Type Nov. Zool. 1914 / Rothschild Bequest 1939–1. Neallotype ♂. Type Pl. / Central Ceram, Mansuela, 2500 ft. Oct–Nov. '19 C. F. & J. Pratt / T. procus Roth. Plesiotype Talbot (1920 : 398) / Presented by J. J. Joicey Esq. Brit.Mus. 1931–291. 2 ♂ paraneallotypes, 1 ♂, same data as neallotype ♂. 1 ♂ 29–20 Central Ceram, 4000 ft. Jan. '20. C. F. & J. Pratt / Joicey Bequest Brit.Mus. 1934–120 / Figured by F. E. Zeuner. fig. 41.

Currently placed as a subspecies of *Ornithoptera* (*Schoenbergia*) *goliath* Oberthür.

prominens Joicey & Noakes, 1915 : 361 (as subsp. of *Papilio* (*Troides*) *tithonus*). Holotype ♀. Type / *O. tithonus* ♀, Momi 4000 ft. Aigah Mts. Onin Peninsula Feb. 1914 / *Papilio* (*Troides*) *tithonus prominens* Joicey & Noakes ♀ type / T.E.S. 1916 pl. lvi. fig. 7. / Joicey Bequest Brit. Mus. 1934–120. Allotype ♂. Allotype / Angi Lakes, Arfak Mts. 6000 ft. North N.Guinea. March 1914. A. C. & F. Pratt / *O. tithonus prominens* J. &. N. ♂ Type / T.E.S. 1916 p. 361 pl. lv. fig. 7. Presented by J. J. Joicey Esq. Brit. Mus. 1931–291.

Currently placed as a subspecies of *Ornithoptera* (*Schoenbergia*) *tithonus* De Haan.

pronomus Gray, 1852 : 2 (as sp. of *Papilio*). 1 ♂ syntype. Type / Cape York – 51–5 / Cape York 51–5 / *O. Poseidon* ♂ Cape York / B.M. Type No. Rh.10808 *Papilio pronomus* ♂ Gray.

Currently placed as a subspecies of *Ornithoptera priamus* (L.).

reginae Salvin, 1888 : 117 (as sp. of *Ornithoptera*). 1 ♂, 2 ♀ syntypes. 1 ♂, Type / Godman-Salvin Coll. 95–5. N.W.Bay Maleita I., Solomon Is. Woodford 26 May 86. / *reginae* Salvin & Godman / B.M. Type No. Rh.10798 *Ornithoptera reginae* Salvin ♂. 1 ♀, Type / Godman-Salvin Coll 95–5. N.W.Bay Maleita I. Solomon Is. Woodford 27 May '86 / *reginae* Salvin & Godman / B.M. Type No. Rh.10799 *Ornithoptera reginae* Salvin ♀. 1 ♀, Paratype / Godman-Salvin Coll. 95–5 N.W.Bay, Maleita I., Solomon Is. Woodford. 28 May '86 / B.M. Type No. Rh.10800 *Ornithoptera reginae* Salv. ♀.

Currently placed as a subspecies of *Ornithoptera* (*Aetheoptera*) *victoriae* Gray.

regis Rothschild, 1895*a* : 79 (as subsp. of *Troides victoriae*). 1 ♂, 1 ♀ syntypes. 1 ♂, Type / Salomo Archip. Bougainville C. Ribbe / *Troides victoriae regis* Rothsch ♂ type ! Entomol 1895 / Figured and described in Vol. I 'Icones Orn' / Rothschild Bequest B.M.1939–1. 1 ♀, Salomo Archip. Bougainville, C. Ribbe / *Troides victoriae regis* Rothsch ♀ type ! Entomol 1895 / See 'Icones Orn' Vol. I / Rothschild Bequest B.M.1939–1.

Currently placed as a subspecies of *Ornithoptera* (*Aetheoptera*) *victoriae* Gray.

rhadamantus Lucas, 1835 : 5 (as sp. of *Ornithoptera*). 1 ♂ syntype, Cotype / Philippines, Museum de Paris / Joicey Bequest Brit.Mus. 1934–120.

Currently placed as a species of *Troides*.

rhyparia Jordan, 1908 : 24 (as ♀ form of *Papilio helena heliconoides*). 4 ♀ syntypes. 1 ♀, Andamans / ♀ f. *rhyparia* Jord. Type. in Seitz IX.1908 / Rothschild Bequest B.M.1939–1. 3 ♀, same data but without type reference.

Currently placed as a ♀ form of *Troides helena heliconoides* (Moore).

richmondia Gray, 1852 : 2 (as sp. of *Papilio*). 1 ♂ syntype, Type / Austr. Richmond 50–114 / Richmond River. Australia 50–114 / B.M. Type No. Rh.10810 *Papilio richmondia* ♂ Gray.

The other male and the female mentioned by Gray are missing from the collection.

Currently placed as a subspecies of *Ornithoptera priamus* (L.).

rothschildi Kenrick, 1911 : 17 (as sp. of *Ornithoptera*). 1 ♂, 1 ♀ syntypes. Warmassin, 6000 ft. North New Guinea March 1910, C. &. F. Pratt. / Kenrick Coll. Brit.Mus. 1928–34.

Currently placed as a species of *Ornithoptera* (*Schoenbergia*).

rubianus Rothschild, 1904*b* : 654 (as subsp. of *Troides victoriae*). 2 ♂, 11 ♀ syntypes. 1 ♂, Type / Rendova, Solomon Is., Feb., 1904 (A. S. Meek) / *T. victoriae rubianus* Type. Nov. Zool 1904 p. 654 R. / Rothschild Bequest B.M.1939–1. 1 ♂, 11 ♀ same data but without type reference.

Currently placed as a subspecies of *Ornithoptera* (*Aetheoptera*) *victoriae* Gray.

ruficollis Butler, 1877 : 552 (as sp. of *Ornithoptera*). 1 ♂ syntype. Type – *O. ruficollis* Butler ♂ Malacca 76–46 / Malacca Pinwell 76–46 / *O. ruficollis* Butler Type / B.M. Type No. Rh.10818 *Ornithoptera ruficollis* ♂ Butler.

Currently placed as a subspecies of *Troides amphrysus* (Cramer).

sagittatus Fruhstorfer, 1896 : 123 (as subsp. of *Ornithoptera helena*). 2 ♂, 3 ♀ syntypes. 2 ♂, Lombok Sapit 2000′ April 1896 H. Fruhstorfer / *sagittatus* Fruhst. / Fruhstorfer Coll. B.M.1937–285. 1 ♀, Type /

Lombok Sapit 2000′ Mai–Juni 1896 H. Fruhstorfer / *sagittatus* Fruhst. / Rothschild Bequest B.M. 1939–1. 2 ♀,Type / Lombok Sapit 2000′ April 1896 H. Fruhstorfer / Fruhstorfer Coll. B.M.1937–285.
Currently placed as a subspecies of *Troides helena* (L.).

samson Niepelt, 1913 : 281 (as form of *Ornithoptera supremus*). 1 ♂, 1 ♀ syntypes. 1 ♂, Type HT / Original / N.E. New Guinea. Arfak Mts. *samson* Niep. ♂ type / *supremus* var ♂ / 16–28 Photo taken H.J.C. / Presented by J. J. Joicey Esq. Brit.Mus. 1931–291. 1 ♂, Type / Type AT / Original / Arfak Geb. D.N. Guinea / 16–28 / *Ornithoptera samson* ♀ Arfak Gebirge, Neu Guinea / Presented by J. J. Joicey Esq. Brit.Mus. 1931–291.
Currently placed as a subspecies of *Ornithoptera* (*Schoenbergia*) *goliath* Oberthür.

sciara Jordan, 1908 : 23 (as ♀ form of *Papilio helena sagittatus*). 5 ♀ syntypes. 1 ♀, Type / Ampenam VIII.96. Everett / ♀ f. *sciara* Type Jord. in Seitz IX.1908 / 1 ♀ same data but without type reference. 1 ♀, Ampenam, Lombok 26.VII.96 Everett. 2 ♀, Lombok VI.96.1500 ft. Everett. All Rothschild Bequest B.M.1939–1.
Currently placed as a synonym of the ♀ *Troides helena sagittatus* (Fruhstorfer). **Syn. n.**

sordidus Joicey & Talbot, 1924 : 565 (as aberration of *Papilio* (*Troides*) *helena oblongomaculatus*). Holotype ♂. Type HT / New Guinea / Ex Grose-Smith 1910 / *P. helena oblongomaculatus* ab. sordidus J. &. T. ♂ HT / Presented by J. J. Joicey Esq. Brit.Mus. 1931–291.
Currently placed as an aberration of *Troides oblongomaculatus* (Goeze).

spilotia Rothschild, 1908 : 4 (as subsp. of *Troides helena*). 1 ♂, 2 ♀ syntypes. 1 ♂, Wuteryang, Hainan May 1903 / Rothschild Bequest B.M.1939–1. 2 ♀, Mt. Wuchi, Hainan May. 1903 / Rothschild Bequest B.M.1939–1.
Currently placed as a subspecies of *Troides helena* (L.).

tarunggarensis Joicey & Talbot, 1926 : 1 (as subsp. of *Troides meridionalis*). Holotype ♀. Type HT / 55–21 Nomnagihé 25 miles south of Wangaar, 2000 ft. Dutch N.Guinea. Jan–Feb 1921 C., F., & J. Pratt. / *Troides meridionalis tarunggarensis* J. & T. Type H.T. / Presented by J. J. Joicey Esq. Brit.Mus. 1931–291. 1 ♀ paratype. Paratype / 55–21 Wangaar River, 15 miles from Coast. ca 600 ft Jan. 1921. C., F., & J. Pratt / Joicey Bequest Brit.Mus. 1934–120.
Currently placed as a subspecies of *Ornithoptera* (*Schoenbergia*) *meridionalis* (Rothschild).

teucrus Joicey & Talbot, 1916*a* : 67 (as subsp. of *Papilio priamus*). 28 ♂, 22 ♀ syntypes. All labelled : Biak, Schouten Is., North N.Guinea June 1914. A. C. and F. Pratt. 1 ♂, Type / *Papilio* (*Troides*) *priamus teucrus* Joicey & Talbot. Type (H.T.) / Presented by J. J. Joicey Esq. Brit.Mus. 1931–291. 1 ♀, as above ♂ but ♀ Type replacing Type (H.T.). 1 ♂, Co-type / 1916–36 B.M. Type No Rh 10805 *P.* (*Troides*) *priamus* ssp. *teucrus* J. &. T. 1 ♂ as last but B.M. Type No. Rh 10804. 1 ♂ as last but Paratype / B.M. Type No Rh 10806. 1 ♂ Presented by J. J. Joicey Esq. Brit.Mus. 1931–291 / Figured by F. E. Zeuner fig 59. 1 ♂, as last but not dissected by Zeuner. 1 ♂, 1 ♀ B.M.1916–36. 2 ♂, 2 ♀ Brit.Mus. 1925–495. 1 ♂, 1 ♀ Brit.Mus. 1927–342. 13 ♂, 13 ♀, Joicey Bequest Brit.Mus. 1934–120. 1 ♂, Cotype / *P. priamus teucrus* Joicey & Talbot. Cotype / Rothschild Bequest 1939–1. 5 ♂, 1 ♀ Rothschild Bequest B.M.1939–1. 1 ♀, *P. Priamus teucrus* ♀ H–W with spot in cell and second spot in 6 absent / Rothschild Bequest B.M.1939–1. 1 ♀, *O. priamus teucrus* J. & T. ♀ / Levick Bequest 1941–83.
Currently placed as a subspecies of *Ornithoptera priamus* (L.).

titan Grose-Smith, 1900 : 388 (as sp. of *Ornithoptera*). Holotype ♂. Type H.T. / Type / New Guinea / *Titan* Gr.–Sm. New Guinea. Type / Ex Grose–Smith 1910 / Figured and redescribed in Rippon's 'Icones Ornithopterorum' Vol. II / Buchanan 30 to 40 Miles inland from Kapa Kapa 1901 / Presented by J. J. Joicey Esq. Brit.Mus. 1931–291.
Currently placed as a subspecies of *Ornithoptera* (*Schoenbergia*) *goliath* Oberthür.

tithonus de Haan, 1840 : 18 (as sp. of *Ornithoptera* (*Orniphoptera* [*sic*]). Neallotype ♀ Oberthür (1885 : 122). Ne Type A.T. / Waigiou Depuiset (par Mre. Laglaize) / Figuré Etudes X, pl. III / a servi de modèle à d'Apreval 1887 / *O. tithonus* ♀ Waigiou ex Oberthür, Coll. Fig 10 pl3 Etudes Entog Vol. 13. Type / Levick Bequest B.M.1941–83.
Currently placed as a ♀ of *Ornithoptera* (*Schoenbergia*) *tithonus waigeuensis* (Rothschild).

typhaon Rothschild, 1908 : 4 (as subsp. of *Troides helena*). 6 ♂, 7 ♀ syntypes. 1 ♀, Type / N.E. Sumatra, low elev. (Dr. Martin) ♀. f. *aplotia* Type Jord. in Seitz IX.1908. 2 ♂ same data but without type reference. 2 ♂, N.E. Sumatra 27.i.95. 1 ♂, Selesseh, N.E. Sumatra 24.ix.93 (Dr. Martin). 1 ♂ as last iv.93. 2 ♀, as last 3.ii.93, 1 ♀ as last 28.iv.93. 1 ♀, as last 10.iv.93. 1 ♀, as last 17.v.93. 1 ♀, Type / N.E. Sumatra, low elev (Dr. Martin) / ♀ f. *phycia* Type Jord. in Seitz IX.1908. All Rothschild Bequest B.M.1939–1.

It is suggested that should the need arise for a lectotype to be designated the female 'type' of *phycia* Jordan be selected as this would then make *phycia* Jordan a synonym of the nominate ♀ form of *typhaon*.
Currently placed as a subspecies of *Troides helena* (L.).

victoriae Gray, 1856*a* : 7 (as sp. of *Papilio* (*Ornithoptera*)). Holotype ♀. Type / 55–69 / 265 / Feejee or Solomon Isl / Guadalcanar Wanderer Bay? [Macgillivray] Voyage of H.M.S. Herald 55–69 / B.M. Type No. Rh10801 *Papilio* (*O.*) *victoriae* ♀ Gray.
Currently placed as a species of *Ornithoptera* (*Aetheoptera*).

vistara Fruhstorfer, 1906*b* : 99, 105 (as subsp. of *Ornithoptera amphrysus*). 1 ♀ syntype. Type / PuloTello, Fruhstorfer / *amphrysus vistara* Fruhst. / Fruhstorfer Coll B.M.1933–131.
Currently placed as a subspecies of *Troides amphrysus* (Cramer).

waigeuensis Rothschild, 1897 : 179 (as subsp. of *Troides tithonus*). 2 ♂, 4 ♀ syntypes. 1 ♀, Type HT / Waigeu Staudinger / Rothschild Bequest B.M.1939–1. 2 ♂, 3 ♀, Paratype / Waigeu, Staudinger / Rothschild Bequest B.M.1939–1.
Currently placed as a subspecies of *Ornithoptera* (*Schoenbergia*) *tithonus* De Haan.

zacheri Suffert, 1908 : 235 (as sp. of *Ornithoptera*). Holotype ♂. Type / Deli District, N.E. Sumatra / *O. neomiranda* Fruh. 1903 Soc. ent. Type! / *Ornithoptera zacheri* Suffert Ins-Börse 1903 Type! / Rothschild Bequest B.M.1939–1.
Currently placed as a synonym of *Troides miranda neomiranda* Fruhstorfer.

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Titles to be published in Volume 36

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Leaf-litter Thysanoptera of the subtribe Williamsiellina (Phlaeothripidae)

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Contents

Synopsis

Species in the Williamsiellina have shorter maxillary stylets than other Phlaeothripidae, the stylets being restricted to the mouth cone as in the sub-order Terebrantia. These species live in leaf litter and on dead wood, mainly in the tropics, and probably feed on fungal hyphae. *Williamsiella bicoloripes* apparently feeds on the fungal component of lichens without digesting the green algae. Keys are provided to the seven genera and 29 species in this subtribe. One genus is recalled from synonymy, two genera are placed in synonymy, four new species are described and six new combinations are established. As a result of this reclassification *Sophiothrips*, *Williamsiella* and *Zaxenothrips* are restricted to New World species, and *Nanothrips* is restricted to Old World species (except *bicolor*).

Introduction

Tubuliferous Thysanoptera usually have much longer stylets than the species in the Terebrantia, indeed the maxillary stylets in many genera are retracted into the head as far as the compound eyes and in some specialized forms are even coiled or convoluted (Mound, 1970*b*). However, the stylets of the species in the Williamsiellina usually lie posterior to the vertex, or even posterior to the anterior margin of the pronotum when viewed from the dorsal surface (Figs 2, 6, 13). These stylets are thus restricted to the mouth cone as they are in the Terebrantia. The only other group of Tubulifera with stylets reduced to a comparable length is the genus *Antillothrips* in the tribe Haplothripini. This is an unrelated genus found on Gramineae throughout the tropics (Pitkin, 1976), apparently feeding on leaf tissue.

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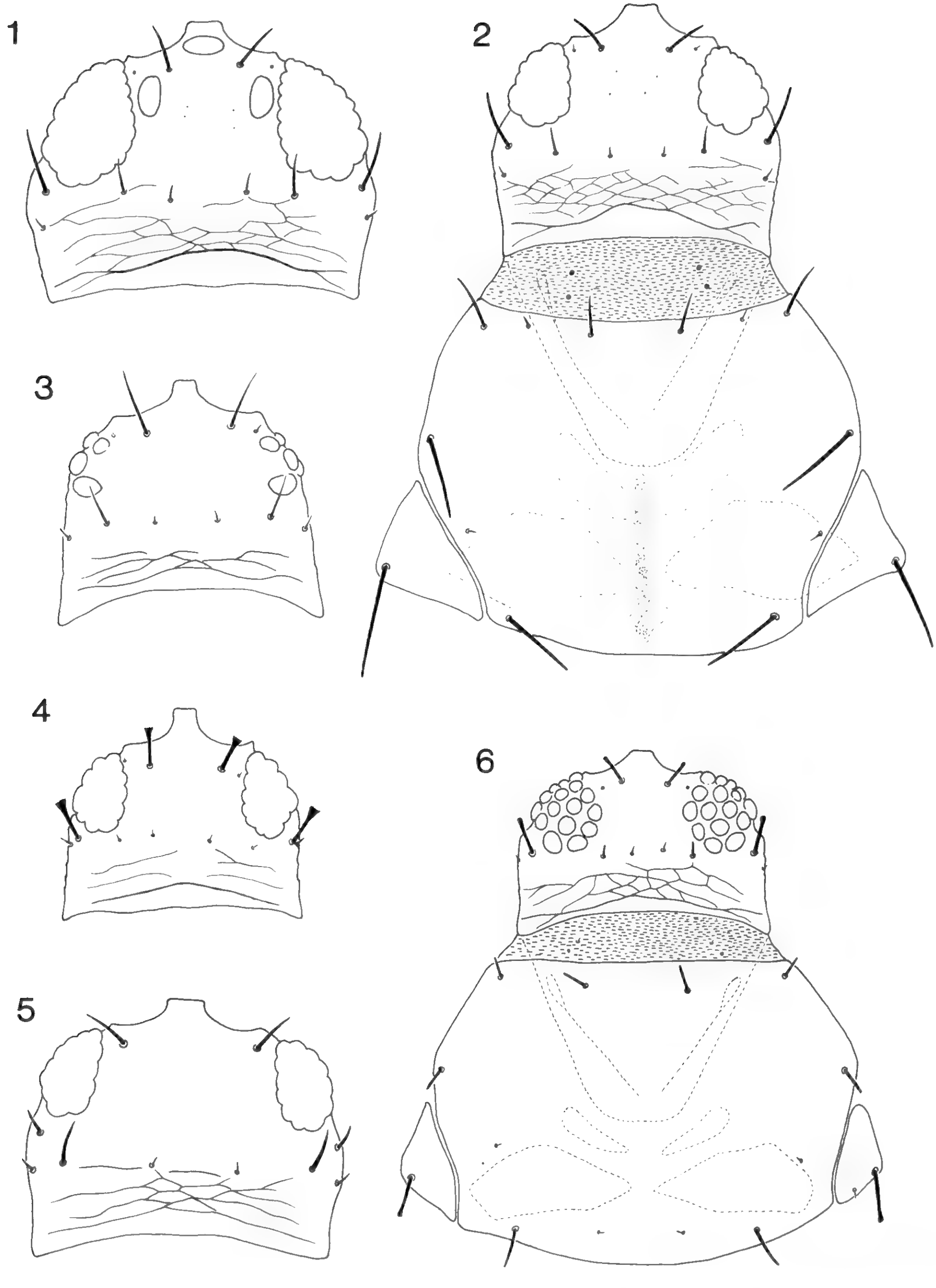
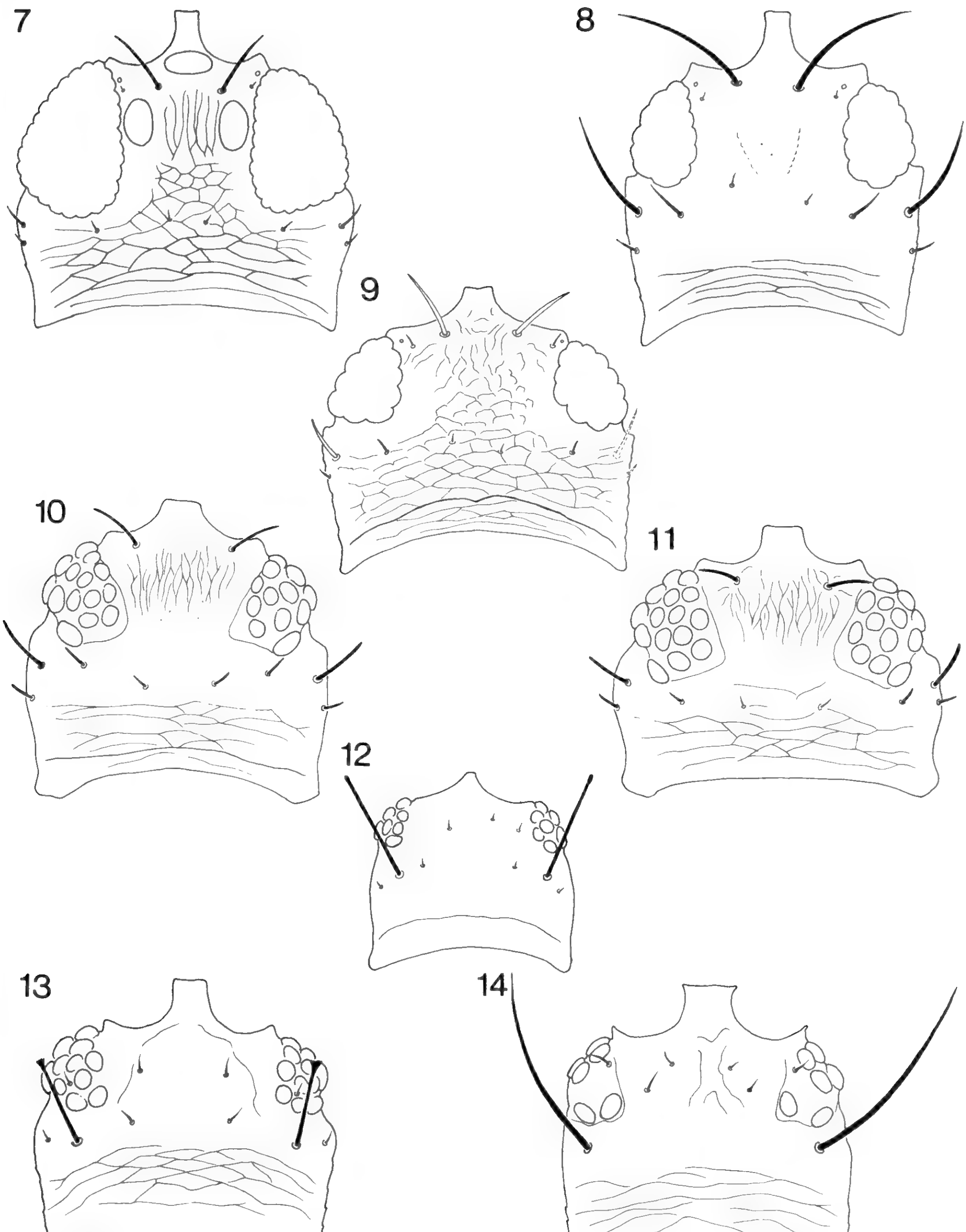


Figs 1–6 Heads of *Nanothrips* species. (1) ***kibbyi*** ♀ macroptera; (2) ***kibbyi*** ♂; (3) ***parviceps*** ♀; (4) ***bicolor*** ♀; (5) ***terminalis*** ♀; (6) ***boltoni*** ♀.



Figs 7–14 Heads of Williamsiellina species. (7) *Sophiothrips spadix* ♀ macroptera; (8) *S. spadix* ♂; (9) *S. spadix* ♀ microptera; (10) *Zaxenothrips peculiaris* ♂; (11) *Z. peculiaris* ♀; (12) *Phthirothrips morgani* ♀; (13) *P. jacoti* ♀; (14) *Williamsiella bicoloripes* ♀.

The species of the Williamsiellina (a subtribe of the Hoplothripini) are found in leaf litter or on dead branches in the tropics and warm temperate parts of the world. They probably feed on fungal hyphae or the breakdown products associated with hyphal decay, although *Williamsiella bicoloripes* apparently feeds on the fungal component of lichen. The author has collected this species from the stems of a live *Hibiscus* bush in Trinidad which were covered in lichen. The gut contents of this species frequently contain large quantities of green pigment which shows no signs of undergoing digestion, and which is probably derived from chloroplasts of unicellular algae.

The members of this subtribe are amongst the smallest known Tubulifera. The head is particularly small, often much shorter than wide, and the tube is also short. Most individuals are apterous and have the pterothorax with its internal furcae, as well as the pelta, reduced. However, the pronotum is often enlarged, much larger than the head. The males exhibit allometric growth patterns in *Nanothrips*, *Sophiothrips* and *Zaxenothrips*, and moreover in these genera they sometimes bear an unusual conical tubercle on the posterior margin of tergite nine and a similar tubercle on the ventral surface of the head between the eyes.

No key has been published to the members of this group except for that by Stannard (1968) which includes the seven species recorded from eastern North America. Moreover there has been little agreement on the status of the genera. Hood (1954*a*) treated both *Nanothrips* and *Zaxenothrips* as synonyms of *Sophiothrips* and although this was followed by Ananthakrishnan (1969) *Zaxenothrips* is used by Stannard (1968) and all three genera are referred to by Zur Strassen (1974). These genera can be distinguished by means of the key given below only as a result of the transfer of several species out of *Sophiothrips*. As interpreted here *Sophiothrips*, *Williamsiella* and *Zaxenothrips* include only New World species whereas *Nanothrips* includes only Old World species (except *bicolor* from Florida). Moreover *Phthirothrips* includes six New World species together with *pediculus* from Liberia and *jacoti* from Angola. This congruence of distribution and morphological characters is taken to reinforce the present generic concept. These genera could be divided into smaller groups, but in the opinion of the present author a series of monobasic genera would serve little practical purpose. The two genera *Pueblothrips* and *Sophikothrips* may not be related to the other members of this group.

Depositories

The following abbreviations have been used for depositories. The author is grateful to the curators of these collections for their support and encouragement. AMG – Albany Museum, Grahamstown, South Africa (Mr C. Jacot-Guillarmod); BMNH – British Museum (Natural History); FSAC – Florida State Arthropod Collection, Gainesville, U.S.A.; INHS – Illinois Natural History Survey, Urbana, U.S.A.; IPE – Institut für Pflanzenschutzforschung, Eberswalde (Dr G. Schliephake); PPRI – Plant Protection Research Institute, Pretoria, South Africa (Dr E. K. Hartwig); SMF – Senckenberg Museum, Frankfurt-am-Main (Dr R. Zur Strassen); TNA – Professor T. N. Ananthakrishnan, Loyola College, Madras, India; USNM – United States National Museum of Natural History, Washington D.C., U.S.A. (Kellie O'Neill).

Systematic section

Checklist of the subtribe Williamsiellina

NANOTHRIPS Faure **gen. rev.**
- *Bagnalliola* Priesner **syn. n.**
- *Nanimothrips* Zur Strassen **syn. n.**
- ***bicolor*** (Watson & Preer) **comb. n.**
- ***boltoni*** **sp. n.**
- ***breviceps*** Faure
- ***kibbyi*** **sp. n.**
- ***makaronesicus*** (Zur Strassen) **comb. n.**
- ***nigrus*** (Ananthakrishnan) **comb. n.**
- ***parviceps*** Faure
- ***terminalis*** (Bagnall) **comb. n.**
- ***typicus*** Ananthakrishnan **sp. rev.**

PHTHIROTHRIPS Priesner
- ***brasiliensis*** Priesner
- ***brevisetis*** Hood
- ***jacoti*** **sp. n.**
- ***johanseni*** **sp. n.**
- ***longiceps*** Hood
- ***morgani*** Hood
- ***nemoralis*** Hood
- ***pediculus*** Priesner

PUEBLOTHRIPS Stannard
- ***minuta*** Stannard

SOPHIKOTHRIPS Mound
malaitae Mound

SOPHIOTHRIPS Hood
comptus Hood
panamensis Hood
politus Hood
spadix Hood
squamosus Hood
verrucosus Hood

WILLIAMSIELLA Hood
bicoloripes Hood

ZAXENOTHRIPS Crawford
peculiaris Crawford
unicolor (Hood) **comb. n.**
vorticosus (Hood) **comb. n.**

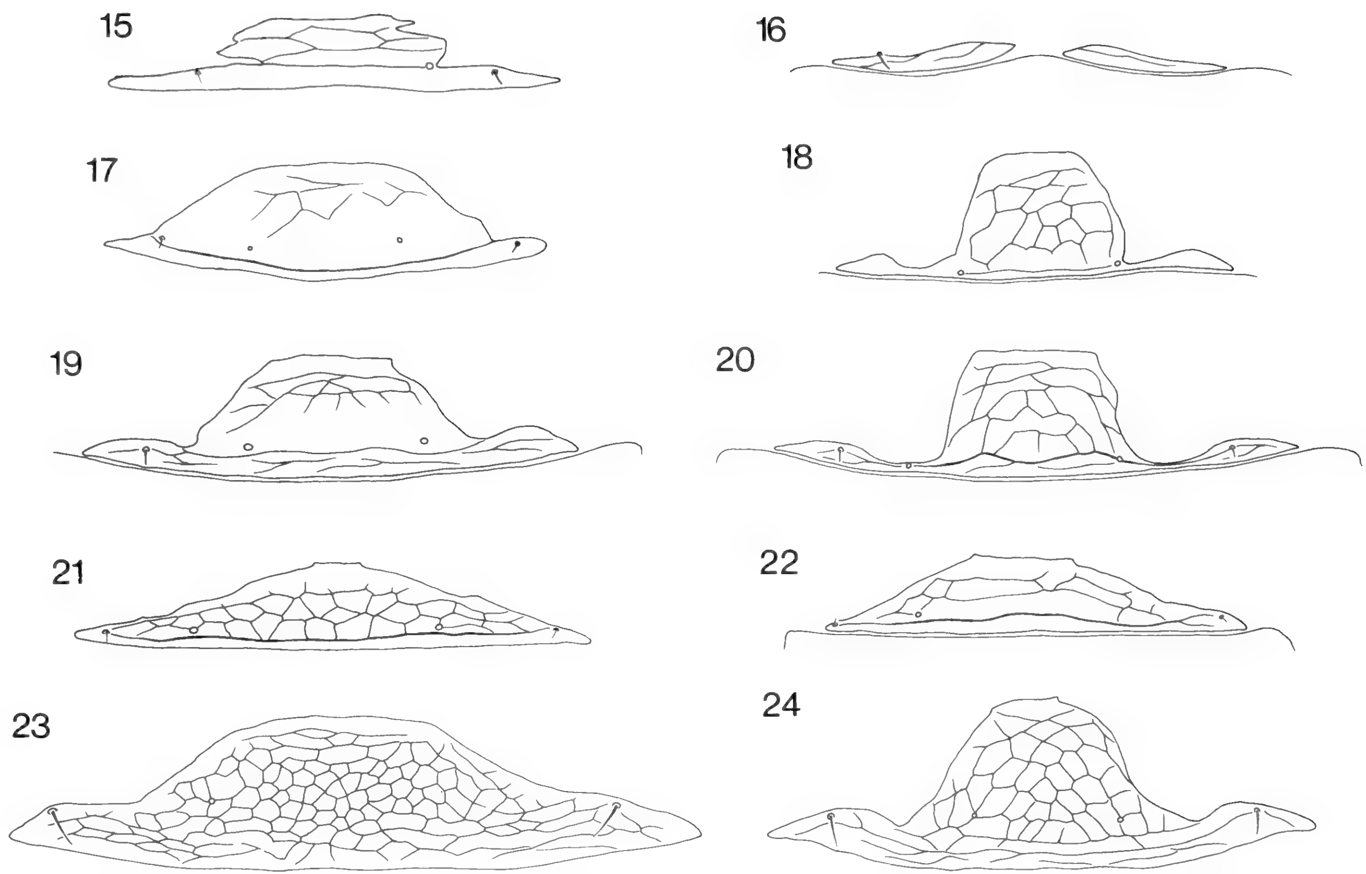
Key to genera

1 Antennal segment III with 3 sense cones 2
– Antennal segment III with 0 or 1 or 2 sense cones (Figs 31–42) 3
2 Abdominal tergites with 1 pair of wing-retaining setae; forewing without duplicated cilia; antennal segment IV with 4 sense cones . . . . . ***SOPHIKOTHRIPS*** (p. 186)
– Abdominal tergites with 2 pairs of wing-retaining setae; forewing with duplicated cilia; antennal segment IV with 3 sense cones . . . . ***PUEBLOTHRIPS*** (p. 186)
3 Antennal segment III shorter than II (Figs 37–40); epimeral sutures incomplete, usually with all pronotal setae and mesonotal setae long with apices expanded; setae B_1 on tergite IX usually longer than tube; posterior margin of pelta close to anterior margin of tergite II (Figs 27–29) . . . . ***PHTHIROTHRIPS*** (p. 181)
– Antennal segment III usually longer than II; epimeral sutures complete, if incomplete then pelta widely separated from tergite II; usually with anterior setae on pronotum short, mesonotal midlateral setae short; setae B_1 on tergite IX usually shorter than tube; pelta variable 4
4 Pelta reduced, posterior margin not close to tergite II (Figs 25, 26) 5
– Posterior margin of pelta close to anterior margin of tergite II (including *N. parviceps* in which the pelta is divided into two sclerites) (Figs 15–24) 6
5 Antennal segments VII and VIII fused, III with no sense cones (Fig. 36); eyes with about 8 facets (Fig. 14); interocellar setae minute; fore tarsus without a tooth in either sex; pronotal anteromarginal, anteroangular and midlateral setae minute, epimeral setae exceptionally long; epimeral sutures not complete; setae B_1 on tergite IX longer than tube . . . . ***WILLIAMSIELLA*** (p. 189)
– Antennal segments VII and VIII separated by a suture, III with 1 sense cone (Fig. 35); eyes with about 20 facets (Figs 10, 11); fore tarsal tooth of ♀ present or absent; interocellar, and anterior pronotal setae small but stout; epimeral sutures complete; setae B_1 on tergite IX shorter than tube . . . . ***ZAXENOTHRIPS*** (p. 190)
6 Antennal segment III with 0 or 1 sense cone (Figs 31–34) . . . ***NANOTHRIPS*** (p. 175)
– Antennal segment III with 2 sense cones (Figs 41, 42) . . . ***SOPHIOTHRIPS*** (p. 186)

NANOTHRIPS Faure **gen. rev.**

Nanothrips Faure, 1938 : 3. Type-species: *Nanothrips breviceps* Faure, by original designation and monotypy.
Bagnalliola Priesner, 1949 : 95. Type-species: *Brachythrips terminalis* Bagnall, by original designation and monotypy. **Syn. n.**
Nanimothrips Zur Strassen, 1974 : 120–123. Type-species: *Nanimothrips makaronesicus* Zur Strassen, by original designation and monotypy. **Syn. n.**

Bagnalliola can be distinguished from *Nanothrips* by the lack of a sense cone on the third antennal segment. This is not accepted here as warranting a generic difference, particularly in view of the variation in number of sense cones in the genus *Phthirothrips*. The type-species of *Bagnalliola* also has the pterothoracic furca slightly less well developed than in the other species treated here in *Nanothrips*, and the median length of tergites three and four is less than in all the species apart from *nigrus* and *parviceps*. Moreover the relative lengths of the postocular setae are different in both *terminalis* and *parviceps* from the other members of *Nanothrips*. The type-species of *Nanimothrips* is unusual in that the female lacks a fore tarsal tooth, but most of the other characteristics



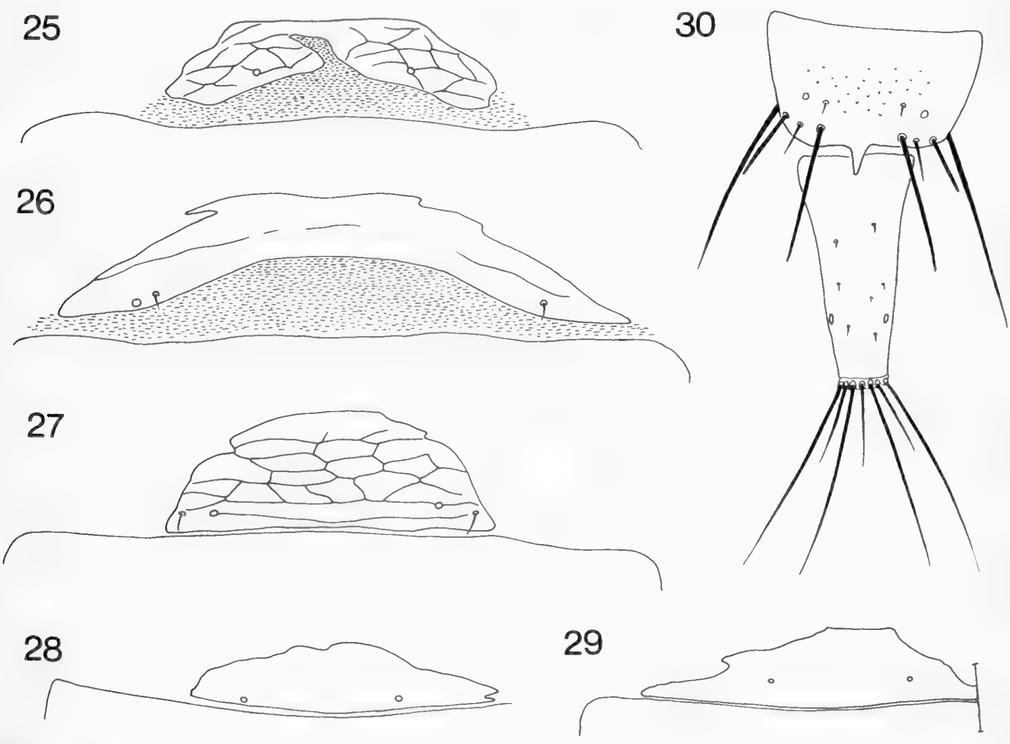
Figs 15–24 Abdominal tergite I (pelta) of Williamsiellina species. (15) *Nanothrips terminalis*; (16) *N. parviceps*; (17) *N. breviceps* ♀ aptera; (18) *N. breviceps* ♀ macroptera; (19) *N. kibbyi* ♀ aptera; (20) *N. kibbyi* ♀ macroptera; (21) *N. makaronesicus* ♀ aptera; (22) *N. boltoni* ♀; (23) *Sophiothrips spadix* ♂ aptera; (24) *S. spadix* ♀ macroptera.

used to distinguish this genus are related to the greater reduction of the pterothorax. If *makaronesicus* is placed in a separate genus then *parviceps*, *terminalis* and *bicolor* must also be segregated to their own genera. At present there seems little advantage in recognizing such a series of monobasic genera in this group, and the present interpretation has the advantage of associating all the Old World species (plus *bicolor*) in *Nanothrips* and the New World species in *Sophiothrips* and *Zaxenothrips*.

Apterous or macropterous; head small with stylets restricted to mouth cone; one pair of ocellar setae well developed; major postocular setae usually lateral in position. Antennae 8-segmented, VII and VIII closely joined, VI enlarged and longer than VII + VIII. Pronotal setae short; epimeral sutures complete; praepectus and mesopraesternum present or absent; foretarsal tooth usually present. Pterothorax usually greatly reduced; forewings, when present, parallel-sided without duplicated cilia, subbasal setae with B_2 arising posterior to B_1. Mid and hind femora each with one large dorsal seta, tibiae with one long, external, subapical seta. Pelta variable; tergites III–VII with 1 pair of wing-retaining setae in macropterae; setae on tergite IX shorter than tube; tube short; ♂ frequently with median tubercle on posterior margin of tergite IX; ♂ without sternal glandular areas.

Key to species

1 Pelta divided into two small sclerites (Fig. 16); eyes with less than 10 facets (Fig. 3); ♂ with a median tubercle on tergite IX [South Africa] . . . . ***parviceps*** (p. 180)
– Pelta entire, not divided into two; eyes with more than 20 facets; ♂ with or without a tubercle on tergite IX 2
2 Antennal segment III without any sense cone (Fig. 31) [France]. ***terminalis*** (p. 181)
– Antennal segment III with 1 sense cone (Figs 32–34) 3
3 Abdominal segments II–V yellow in contrast to brown of thorax 4



Figs 25–30 Abdominal tergite I (pelta) and tergites IX–X of Williamsiellina species. (25) *Zaxenothrips peculiaris*; (26) *Williamsiella bicoloripes*; (27) *Phthirothrips jacoti* ♀ aptera; (28) *P. johanseni*; (29) *P. pediculus* (specimen partly rotated); (30) *Nanothrips kibbyi* ♂.

– Abdominal segments II–V brown, similar in colour to thorax 6
4 Interocellar, postocular, metanotal and femoral dorsal setae all with apices broadly expanded (Fig. 4); ♂ without a tubercle on posterior margin of tergite IX [U.S.A.: Florida, Texas] . . . . **bicolor** (p. 178)
– Major setae blunt or acute at apex, never broadly expanded; ♂ with a tubercle on posterior margin of tergite IX 5
5 Hind femora yellow; abdominal segments II–IX yellow with brown markings laterally; apterous ♀ with tube length 1·9 times basal width; tubercle on tergite IX of male scarcely 10 μm long [South-east Africa] . . . . **breviceps** (p. 179)
– Hind femora brown in basal half, yellow distally; all tibiae yellow with a brown patch medially; abdomen yellow but posterior margin of VIII and anterior margin of IX brown; apterous ♀ with tube length 1·6 times basal width; tubercle on tergite IX of ♂ 20 μm long [India] . . . . **typicus** (p. 181)
6 Head yellow, in contrast to brown pronotum, occipital ridge brown; tergite IX yellow . . 7
– Head as brown as pronotum; tergite IX brown or light brown 8
7 Fore tarsal tooth absent in ♀, present in ♂; pelta strongly reticulate (Fig. 21), also metanotum and tergite II; four minor postocular setae separated from each other by more than the diameter of two eye facets [Azores] . . . . **makaronesicus** (p. 180)
– Fore tarsal tooth present in both sexes; pelta scarcely reticulate (Fig. 22), metanotum and tergite II weakly reticulate; four minor postocular setae separated from each other by diameter of one eye facet (Fig. 6) [Java] . . . . **boltoni** (p. 178)
8 Antennal segments III–V bicoloured, brown with pedicel yellow; tibiae dark brown; tube stout, with sculpture of longitudinal ridges and reticulation; tergite IX setae B_1 acute at apex, more than 0·5 times as long as tube; ♂ without a median tubercle on tergite IX [India] . . . . **nigrus** (p. 180)
– Antennal segments III–V yellow, sometimes weakly shaded in apical half; tibiae yellow; tube slender without sculpture; tergite IX setae B_1 blunt at apex, less than 0·5 times as long as tube; ♂ with a median tubercle on tergite IX (Fig. 30) [Seychelles] . . **kibbyi** (p. 179)

Nanothrips bicolor (Watson & Preer) **comb. n.**

(Fig. 4)

Sophiothrips bicolor Watson & Preer, 1939 : 1–3. Holotype ♀, U.S.A.: Florida (FSAC) [not examined].

This is the only species of *Nanothrips* from the New World. It is rather similar to species of *Phthirothrips*. The female has parallel cheeks and the male slightly concave cheeks. The major setae, including the metanotal setae, all have widely expanded apices.

MATERIAL STUDIED. U.S.A.: Florida, Alachua City, 1 ♀, 1 ♂ paratypes in Spanish moss, 26.ix.1938 (USNM); Texas, Palacios, 2 ♀ in Spanish moss, 23.iv.1939, 1 ♂ on dead branch, 11.i.1939, 1 ♂ on dead grass, 25.iii.1939 (*Hood*) (USNM; AMG).

Nanothrips boltoni **sp. n.**

(Figs 6, 22, 34)

♀ aptera. Colour mainly brown, head yellow with occipital ridge brown, tergite IX yellow, tube reddish yellow; antennal segments I–II yellow, III–VI yellow with brown apices; tarsi yellow, fore tibiae yellow with a brown spot medially, fore femora yellow in distal half, mid and hind femora and tibiae with pale apices.

Head with 4 small setae close together on vertex, postocular and ocellar setae weakly expanded at apex (Fig. 6); antennae typical of genus, suture between VII and VIII weak dorsally, VI very large (Fig. 34). Pronotum broad, epimeral sutures complete; major setae almost cylindrical, apices weakly expanded; praepectus weak, mesopraesternum reduced to two small lateral triangles. Fore tarsus with a small tooth. Meso- and metanota very reduced, metanotum with 8 small setae. Pelta broad (Fig. 22); tergite II with several lines of sculpture medially, remaining tergites very weakly sculptured; setae B_1 and B_2 on IX weakly expanded at apex, B_3 acute; tube faintly reticulate.

Measurements (holotype ♀ in μm). Body length 1020. Head, length 80; width 115; postocular setae 18. Pronotum, length 135; median width 200; major setae, am 15, aa ?15, ml ?15, epim 25, pa 20. Metanotum,

median length without craspedum 50; width 210. Tergite III median length 52. Sternite III median length 58. Tergite IX setae B_1 50; B_2 50; B_3 80. Tube, length 95; maximum width 52; longest terminal setae 110. Antennal segments II–VIII length, 36, 42, 32, 35, 44, 23, 13.

♂ aptera. Colour and structure similar to ♀; fore tarsal tooth larger; tergite IX with a stout triangular median tubercle; setae B_2 on tergite IX short and stout.

Measurements (♂ paratype in μm). Body length 830. Head, length 74; width 100. Pronotum, length 125; median width 170. Tergite III median length 42. Sternite III median length 50. Tergite IX, length of median tubercle 22; seta B_1 50; seta B_2 26; B_3 110. Tube, length 80.

MATERIAL STUDIED. Holotype ♀, JAVA: Bogor Botanical Gardens, from dead twigs, 19.x.1973 (*L. A. Mound* 1127) (BMNH).

Paratype. 1 ♂, collected at same site as holotype, on dead creeper, 18.x.1973 (*L. A. Mound* 1120) (BMNH).

COMMENTS. This species is remarkably similar to *makaronesicus* but the female has a fore tarsal tooth, and setae B_2 on tergite IX of the female are as long as B_1. The specimens were collected by the author during an expedition to south-east Asia with the ant specialist Barry Bolton.

Nanothrips breviceps Faure

(Figs 17, 18)

Nanothrips breviceps Faure, 1938 : 4–6. Holotype ♀, MOZAMBIQUE (PPRI) [examined].

Faure described this species on a single female which had lost its major postocular setae. Subsequently he described the male (1940) and added further details from other females (1946). The species from India, *typicus* Ananthakrishnan, is very similar to *breviceps* but can be distinguished by its colour and the form of the tube in all three morphs. The tibiae of the *breviceps* specimens from Mozambique and Zululand are yellow and the head is pale, but a female from Cape Province has the tibiae brown medially and the head is also brown.

MATERIAL STUDIED. Holotype ♀, MOZAMBIQUE: Magude, on native *Acacia*, 21.vii.1930 (*J. C. F.*).

MOZAMBIQUE: Lourenco Marques, 1 ♂ in fallen leaves, vii.1936 (*J. C. F.*) (PPRI). SOUTH AFRICA: Zululand, Richards Bay, 1 ♀ macroptera on dead branches, 1.vi.1943 (*J. C. F.*); Zululand, St Lucia Lake, 1 ♀ on dead branches, 5.viii.1945 (*J. C. F.*) (USNM); Cape Province, near Kasonga Bridge, 1 ♀ from dry branches, 11.vi.1961 (*Jacot-Guillarmod*) (AMG).

Nanothrips kibbyi sp. n.

(Figs 1, 2, 19, 20, 30, 33)

♀ macroptera. Colour mainly brown, tergite IX and tube brownish yellow; antennal segment I light brown, II yellow but shaded marginally, III yellow, V–VI yellow with shaded apices; femora brown; tibiae and tarsi yellow; forewing shaded medially.

Head with large eyes; antennae typical of genus, suture between VII and VIII complete (fig. 33). Pronotum not enlarged, epimeral sutures complete; major setae blunt at apex; praepectus small, mesopraesternum with two triangular sclerites. Fore tarsal claw very small. Mesonotal lateral setae small or absent. Metanotum weakly reticulate, 2 pairs of minor setae in anterior half, 1 pair of major setae in posterior third. Forewing typical of genus. Pelta with slender lateral wings; anterior tergites weakly sculptured medially, tube slender with almost straight margins; setae B_1 and B_2 on tergite IX blunt at apex.

Measurements (holotype ♀ in μm). Body length 1550. Head, length 125; width 160; postocular setae 30. Pronotum, length 140; median width 225; major setae, am 26, aa 26, ml 30, epim 50, pa 40. Forewing, length 650; distal width 65; subbasal setae 30. Tergite III median length 65. Sternite III median length 65. Tergite IX setae, B_1 60, B_2 70, B_3 115. Tube, length 125, maximum width 65. Antennal segments II–VIII length, 42, 45, 42, 45, 52, 26, 23.

♀ aptera. Colour and sculpture similar to macroptera; head with eyes reduced on ventral surface (Fig. 2); vestigial forewing 10 μm long bearing one seta sometimes present; metanotum devoid of sculpture medially, strongly transverse; pelta variable, lateral wings slender to broad; wing-retaining setae about 5 μm long.

Measurements (largest and smallest ♀ paratype apterae in μm). Body length 1750 (1250). Head, length 120 (90); median width 158 (145). Pronotum, length 165 (130); median width 250 (200). Metanotum, length excluding craspedum 65 (65); width 260 (200). Tergite III length 80 (60). Sternite III length 100 (70). Tergite IX setae B_1 55 (53); B_2 65 (63). Tube, length 115 (100); maximum width 65 (55); terminal setae 130 (130). Antennal segments III–VIII length 44, 39, 44, 52, 29, 23 (38, 35, 38, 45, 26, 20).

♂ aptera. Colour and sculpture similar to ♀; head of large ♂ with small tubercle ventrally between eyes; fore femora and fore tarsal tooth enlarged in large ♂; tergite IX with stout median tubercle, setae B_2 very short.

Measurements (largest and smallest ♂ paratypes in μm). Body length 1300 (1100). Head, length 115 (100); width 130 (125). Pronotum, length 165 (125); median width 225 (180). Tergite III median length 60 (50). Sternite III median length 76 (65). Tergite IX setae B_1 64 (60); B_2 20 (20); B_3 130 (130); median tubercle length 16 (14). Tube, length 110 (95); basal width 55 (50).

MATERIAL STUDIED. Holotype ♀ macroptera, SEYCHELLES: Mahe Botanic Gardens, in compost heap, viii.1975 (*G. Kibby*) (BMNH).

Paratypes. 3 ♀ macropterae, 32 ♀ apterae, 6 ♂ apterae, collected with holotype (BMNH).

COMMENTS. This species is similar to *makaronesicus* but differs in colour and the form of the B_2 setae on the ninth tergite. The available males are smaller than the oedymerous male of *makaronesicus* which has been studied. The female has a small but distinct fore tarsal tooth, and the metanotum of the apterae is almost devoid of sculpture medially. The species is named after Mr Geoffrey Kibby.

Nanothrips makaronesicus (Zur Strassen) **comb. n.**

(Fig. 21)

Nanimothrips makaronesicus Zur Strassen, 1974 : 123–134. Holotype ♀, AZORES (SMF) [not examined].

This species was based on a long series of apterae of both sexes collected in the Azores, Madeira and Canary Islands. Despite the lack of a fore tarsal tooth in the female *makaronesicus* is very similar to *boltoni* and *kibbyi*, and in the opinion of the present author is not sufficiently distinct from *breviceps* and *typicus* to warrant a separate genus. The ventral process on the head between the eyes of large males is also found in *parviceps*, *kibbyi* and *typicus* as well as in *Zaxenothrips unicolor*. Setae B_2 on tergite IX are shorter than B_1 in the females as well as the males, unlike all other members of the genus except *terminalis*.

MATERIAL STUDIED. AZORES: Santo Mario I., 280 m, 1 ♂ paratype on dead *Picconia azorica* 23.v.1969 (*Zur Strassen*). CANARY IS.: Hierro, 630 m, 1 ♀ on dead *Pyrus communis*, 11.iv.1970 (*Zur Strassen*) (BMNH).

Nanothrips nigrus (Ananthakrishnan) **comb. n.**

Sophiothrips nigrus Ananthakrishnan, 1971 : 197. Holotype ♀, INDIA (TNA) [examined].

This is a dark robust species with a relatively long head and stout tube, and with the third and fourth abdominal tergites reduced in length medially. However, the antennae as well as the rest of the body are typical of *Nanothrips*.

MATERIAL STUDIED. Holotype ♀, INDIA: [West Bengal, Darjeeling District,] Kurseong, from 'wild beat', 21.iv.1969 (*Ananthakrishnan* 451) (TNA).

INDIA: 1 ♂, same data as holotype (TNA).

Nanothrips parviceps Faure

(Figs 3, 16, 32)

Nanothrips parviceps Faure, 1946 : 7–10. Holotype ♀, SOUTH AFRICA (PPRI) [examined].

The species from India referred to as *parviceps* by Ananthakrishnan (1969) is a distinct species and is treated below under the name *typicus*. The original description of *parviceps* refers to the

division of the pelta into two sclerites (Fig. 16). Moreover the original figure indicates that the number of eye facets is greatly reduced, and that there are only 3 pairs of setae (not 4) on the head behind the eyes (Fig. 3). These characters suggest that *parviceps* could be placed in a separate monobasic genus, but the structure of the antennae (Fig. 32) is so typical of *Nanothrips* that such action seems unnecessary.

MATERIAL STUDIED. Holotype ♀, SOUTH AFRICA: Zululand, Richards Bay, from dead branches, 1.vi.1943 (*J. C. F.*) (PPRI).

SOUTH AFRICA: 1 ♀, 2 ♂, same data as holotype (PPRI).

Nanothrips terminalis (Bagnall) **comb. n.**

(Figs 5, 15, 31)

Brachythrips terminalis Bagnall, 1927 : 571–573. Holotype ♀, FRANCE (BMNH) [examined].

This species differs from the other members of *Nanothrips* in lacking a sense cone on the third antennal segment, in having the second instead of the third pair of postocular setae elongate, and in having the median length of tergites three and four reduced. However, the general appearance of *terminalis* is very similar to that of the other *Nanothrips* species and there seems little point in dividing these into smaller genera.

MATERIAL STUDIED. Holotype ♀, FRANCE: Tamaris, from *Erica arborea*, iii.1927 (*Bagnall*) (BMNH).

FRANCE: Montpellier, 2 ♀, 2 ♂ on dead branches of *Quercus* and *Tamarix*, 1957–1959 (*Bournier*) (BMNH & USNM).

Nanothrips typicus Ananthakrishnan **sp. rev.**

Nanothrips typicus Ananthakrishnan, 1964 : 120. LECTOTYPE ♂, INDIA (TNA), here designated [examined].

Ananthakrishnan (1969) placed this species as a synonym of *parviceps*, although it seems likely that this was a lapsus for *breviceps*. However, the Indian and African species can be distinguished by means of the key above. The males have a small process on the ventral surface of the head between the eyes as in *kibbyi* and *parviceps*, but this is not as large as in *makaronesicus*. The forewing of the macropterae is shaded at the extreme base and also medially.

MATERIAL STUDIED. Lectotype ♂, INDIA: Madras, on *Sesbania* bark, 18.v.1963 (TNA).

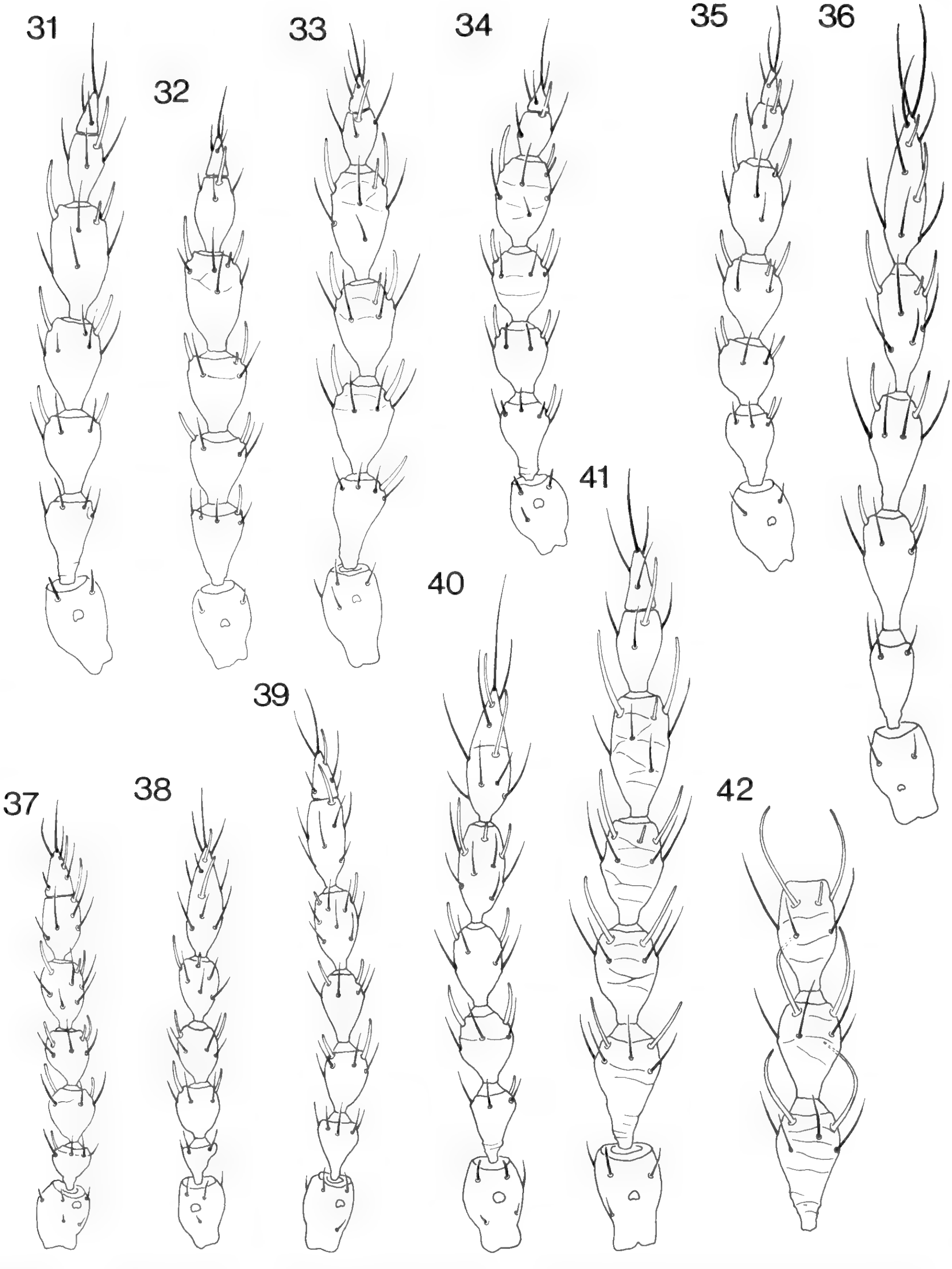
INDIA: 6 ♀, 2 ♀ mac., 2 ♂ from dead twigs, 1966–1969 (BMNH; SMF; TNA).

PHTHIROTHRIPS Priesner

Phthirothrips Priesner, 1933 : 154. Type-species: *Phthirothrips pediculus* Priesner, by original designation and monotypy.

Eight species are recognized in this genus, two from Africa and six from the New World. The species are amongst the smallest in the Tubulifera which may account for the rarity of their collection. J. D. Hood studied large collections of Thysanoptera from dead wood and leaf litter in Brazil and Panama, but apparently only found the genus on three or four occasions. Similarly the present author has studied many collections from Trinidad without finding any *Phthirothrips*. The species are probably associated with fungal hyphae or lichens rather than mosses. Almost all the available specimens are apterous, although *brasiliensis* was described from a single macroptera, and the new species *jacoti* described below from Angola is known from winged and wingless individuals. The genus appears to be a valid member of the Williamsiellina.

Small species, usually apterous with head smaller than pronotum; maxillary stylets confined to mouth cone. Antennae 7- or 8-segmented, III exceptionally short; sense cone formula variable III-0, IV-2 (*morgani, johanseni, brasiliensis*); III-1, IV-2 (*pediculus, nemoralis, longiceps, jacoti*); III-2, IV-3 (*brevisetis*).



Figs 31–42 Right antennae of Williamsiellina species. (31) *Nanothrips terminalis*; (32) *N. parviceps*; (33) *N. kibbyi*; (34) *N. boltoni*; (35) *Zaxenothrips unicolor*; (36) *Williamsiella bicoloripes*; (37) *Phthirothrips pediculus* (partly rotated); (38) *P. morgani*; (39) *P. johanseni* (left antenna); (40) *P. jacoti* ♀ aptera; (41) *Sophiothrips spadix* ♂ aptera; (42) *S. spadix* ♀ macroptera (segments III–V).

Pronotum with epimeral sutures incomplete, praepectus and mesopraesternum weak or absent; major setae usually well developed. Pelta usually transverse and unsculptured; abdomen broader than thorax, median tergites usually not reduced in length medially; setae on tergite IX acute, usually longer than tube. Macroptera with forewing broad, without duplicated cilia, subbasal setae arising in a straight row.

Key to species (excluding *brasiliensis* Priesner)

1 Antennal segment III with 2 sense cones, IV with 3 sense cones; pronotal anteroangular and anteromarginal setae less than 5 μm long, also mesonotal lateral setae; sternite VIII of ♂ with a small circular glandular area [Brazil] . . . . . ***brevisetis*** (p. 183)
– Antennal segment III with 0 or 1 sense cone, IV with 2 sense cones (Figs 37–40); pronotal setae at least 20 μm long; sternite VIII of ♂, where known, with narrow transverse glandular area 2
2 Postocular setae, pronotal major setae and mesonotal lateral setae all slender and finely acute at apex [Mexico] . . . . ***johanseni*** (p. 184)
– Major setae of head and thorax with apices expanded or bluntly rounded 3
3 Pelta strongly reticulate, rectangular, occupying about 0·4 of anterior margin of tergite II (Fig. 27); tergite IX setae B_1 less than 0·8 times as long as tube; ♀ aptera with lateral margins of tube convex [Angola] . . . . ***jacoti*** (p. 184)
– Pelta usually without sculpture, transverse, occupying more than 0·8 of anterior margin of tergite II (Figs 28, 29); tergite IX setae B_1 longer than tube 4
4 Fore tarsal tooth absent; antennal segment II yellow in contrast to brown of segments III–VIII; suture between VII and VIII complete (Fig. 37) [Liberia] . . ***pediculus*** (p. 185)
– Fore tarsal tooth present, small at apex of tarsus; antennal segment II yellow brown to brown; suture between antennal segments VII and VIII absent or incomplete ventrally 5
5 Antennal segment III exceptionally small, without a sense cone (Fig. 38) [eastern U.S.A.] . . . . ***morgani*** (p. 185)
– Antennal segment III with one sense cone 6
6 Antennal segments VII and VIII with a suture indicated dorsally, total length of these segments 1·6 times as long as segment VI (Brazil) . . . . ***longiceps*** (p. 185)
– Antennal segments VII and VIII without any suture, total length 1·2 times as long as VI (Brazil) . . . . ***nemoralis*** (p. 185)

Phthirothrips brasiliensis Priesner

Phthirothrips brasiliensis Priesner, 1937 : 347–348. Holotype ♀, BRAZIL (IPE) [examined].

The unique holotype is a macropterous female with no sense cones on the third antennal segment. The fore tarsus bears a very small apical tooth as in *morgani*, and the pelta is similar to that of *morgani* and *pediculus* (Fig. 29) but a little more triangular. However, the suture between antennal segments seven and eight is complete. Since it is unlikely that a macropterous individual would have fewer sense cones than an aptera of the same species, *brasiliensis* can only be compared to *morgani*, and it may well eventually prove to be the undescribed macropterous form of that species.

Phthirothrips brevisetis Hood

Phthirothrips brevisetis Hood, 1950 : 28–30. Holotype ♀, BRAZIL (USNM) [examined].

This species is unusual in the genus in several respects: antennal segment III not exceptionally small; segments III and IV both with one extra sense cone; anterior pronotal and mesonotal lateral setae exceptionally short; epimeral sutures almost complete in some individuals; fore tarsal tooth absent in ♂ and ♀; sternite VIII of ♂ with glandular area circular.

MATERIAL STUDIED. Holotype ♀, BRAZIL: Estado de Rio de Janeiro, Petropolis, on dead branch, 27.v.1948 (*Hood*) (USNM).

BRAZIL: 21 ♀, 7 ♂ paratypes collected with the holotype or at Boracea, Estado de São Paulo (USNM; 1 ♀ BMNH).

Phthirothrips jacoti sp. n.

(Figs 13, 27, 40)

Apterous ♀. Colour brown, posterior abdominal segments and tube darkest; antennal segments I–IV light brown; major setae dark except at posterior end of abdomen.

Head with cheeks swollen behind eyes (Fig. 13), postocular setae with expanded apices; maxillary stylets visible just anterior to postoccipital ridge. Antennae 7-segmented, suture between VII and VIII faintly and variably indicated on dorsal surface only, III with 1 sense cone, IV and V each with 2 sense cones (Fig. 40). Pronotum with a few lines of sculpture near posterior margin; epimeral sutures not complete; anterior two pairs of setae short and blunt, remaining setae with apices expanded; praepectus and mesopraesternum weakly developed; fore tarsus without a tooth. Mesonotum without a lateral seta. Pelta rectangular to semicircular, surface reticulate (Fig. 27); tergites III–V shorter medially than sternites, lateral setae stout with apices expanded; tergite IX setae finely acute; tube stout with tapering, convex margins.

Measurements (holotype ♀ in μm). Body length 1600. Head, length 130; width 145; postocular setae 50. Pronotum, length 130; width 195; major setae, μm 13, aa 13, ml 40, epim 50, pa 50. Tergite III length 80. Sternite III length 110. Tergite IX setae, B_1 95; B_2 85; B_3 85. Tube, length 115; maximum width 76; apical width 26; terminal setae 55. Antennal segments II–(VII + VIII); length 38, 35, 32, 38, 50, 65.

Macropterous ♀. Colour similar to aptera, wings brown. Head with ocelli, compound eyes larger than aptera; mesonotal lateral setae with apices expanded; forewing parallel-sided, without duplicated cilia, subbasal setae arising in a straight line; tergites III–VII with 1 pair of wing-retaining setae.

Measurements (♀ paratype macroptera in μm). Body length 1500. Head, length 130; width 145; postocular setae 40. Pronotum, length 110; epimeral setae 50. Forewing, length 650; distal width 64; subbasal setae 39, 53, 50. Tergite III length 65. Sternite III length 100. Tergite IX setae B_1 85, B_2 100, B_3 85. Tube, length 130; maximum width 70; apical width 26; terminal setae 65. Antennal segments II–(VII + VIII) length, 38, 32, 32, 38, 50, 70.

Apterous ♂. Colour a little paler than ♀, basal antennal segments almost yellow; structure similar to apterous ♀; sternite VIII with a narrow median transverse glandular area; tergite IX with setae B_2 variable, sometimes shorter than B_1.

Measurements (♂ paratype in μm). Body length, 1200. Head, length 125; width 125. Pronotum length, 125; width 165; epimeral setae 58. Tergite III length 65. Sternite III length 100. Tergite IX setae B_1 80. Tube, length 100.

Material studied. Holotype ♀ aptera, Angola: 30 km north of Vila Luso, 20° 00′ E, 11°00′ S, in hardwood forest litter, i.1949 (*Machado*) (USNM – Hood No. 1486).

Paratypes. Angola: 12 ♀ apterae, 4 ♀ macropterae, 7 ♂ apterae collected with holotype (USNM; BMNH; AMG; Prof. A. Bournier Collection, Montpellier).

Comments. This species is considerably larger than the other species in the genus. The pterothorax and pelta of the apterae are less transverse and reduced than in the other species, and the setae on the ninth tergite are shorter than the tube. The relatively broad head and tube, and the reduction in length of the median tergites are also unusual. This species is named in honour of the South African Thysanoptera specialist Mr C. Jacot-Guillarmod.

Phthirothrips johanseni sp. n.

(Figs 28, 39)

Apterous ♀. Colour medium brown, pedicel of antennal segment III yellow. Head similar in shape to *morgani*, with no sculpture dorsally except one faint line close to post occipital ridge; postocular setae finely acute. Antennae 8-segmented, with a complete suture between VII and VIII; III with 0 sense cone, IV and V with 2 sense cones (Fig. 39). Pronotum similar to *morgani*, epimeral sutures incomplete but major setae long and acute; praepectus well developed, mesopraesternum absent. Fore tarsal tooth present but small; meso- and metanota, also pelta and rest of tergites devoid of sculpture; tergal setae all finely acute; tube typical of genus, short and conical.

Measurements (holotype ♀ in μm). Body length 1250. Head, length 100; width ?80; postocular setae 80. Pronotum, length 115; median width ?150; major setae, am 30, aa 25, ml 52, epim 100, pa 50. Mesonotal lateral seta 32. Tergite IX setae, B_1 165; B_2 165; B_3 130. Tube, length 80, basal width 55; terminal setae, 95. Antennal segments II–VIII length, 35, 29, 32, 32, 38, 45, 23.

MATERIAL STUDIED. Holotype ♀, MEXICO: Nogales, taken in quarantine from orchid debris, 9.v.1966 (*C. H. Spitzen*) (USNM).

COMMENTS. The unique holotype of this species is mounted slightly laterally. It is similar in general appearance to *morgani* but has a complete suture between the seventh and eighth antennal segments, and all the major setae are exceptionally long with finely acute apices. The species is named in honour of the Mexican Thysanoptera specialist Dr R. M. Johansen.

Phthirothrips longiceps Hood

Phthirothrips longiceps Hood, 1960 : 59–61. Holotype ♀, BRAZIL (USNM) [examined].

This species is very similar to *morgani* but is slightly larger with a sense cone on the third antennal segment.

MATERIAL STUDIED. Holotype ♀, BRAZIL: Santa Catarina Province, Nova Teutonia, in leaf litter, v.1957 (*Plaumann*) (USNM).

BRAZIL: 15 ♀, 10 ♂ paratypes with same data as holotype (USNM).

Phthirothrips morgani Hood

(Figs 12, 38)

Phthirothrips morgani Hood, 1941 : 206–208. Holotype ♀, U.S.A.: Florida (USNM) [examined].
Eulissothrips antennatus Morgan *in* Hood, 1941 : 208. [Nomen nudum.]

This species is very similar to *longiceps* and *nemoralis*. All of the available specimens of *morgani* are very small, with a minute fore tarsal tooth and the third antennal segment exceptionally short and lacking a sense cone. The suture between segments VII and VIII is usually not developed at all but is sometimes indicated by a faint dorsal line. Until further collections are made it will not be possible to determine the significance of the small differences between these species which might represent geographic variation in one widespread species. As is discussed above, *brasiliensis* may eventually prove to be the macropterous form of *morgani*.

MATERIAL STUDIED. Holotype ♀, U.S.A.: Florida, Gainesville, from reindeer moss, 19.iii.1933 (*Watson*) (USNM).

U.S.A.: Florida, Alachua City, Sugar Foot Hammock, ♂ paratype from dead leaves on ground, 5.ii.1939 (*Watson*) (USNM); 2 ♀, 2 ♂ with similar data, 1926–1933 (*Watson*) (BMNH); 4 ♀, 4 ♂ from moss, Gainesville, vii–viii.1954 (*Hood*) (USNM). MEXICO: Vera Cruz (collected in quarantine at Laredo, Texas), 1 ♀, 1.xii.1958 (USNM).

Phthirothrips nemoralis Hood

Phthirothrips nemoralis Hood, 1954*b* : 25. Holotype ♀, BRAZIL (USNM) [examined].

The only known specimen of this species is very similar to *morgani* but with a sense cone on the third antennal segment. Both *morgani* and *longiceps* have the combined length of antennal segments VII and VIII 1·6 times as long as the length of segment VI.

MATERIAL STUDIED. Holotype ♀, BRAZIL: Para State, Belem, from dead leaf, 11.viii.1951 (*Hood*) (USNM).

Phthirothrips pediculus Priesner

(Figs 29, 37)

Phthirothrips pediculus Priesner, 1933 : 154–156. Syntypes of both sexes, LIBERIA (SMF; USNM; BMNH) [2 ♀ examined].

The original figure of this species is misleading. The first abdominal tergite is not complete and

bearing two pairs of setae, it is reduced to a transversely elongate and unsculptured pelta (Fig. 29). Moreover the third antennal segment bears 1 sense cone and the fourth and fifth segments each bear 2 sense cones (or $1 + 1^{+1}$). This species differs from *morgani*, *longiceps* and *nemoralis* most obviously in the complete suture between the seventh and eighth antennal segments.

MATERIAL STUDIED. LIBERIA: 2 ♀ syntypes (labelled paratypes), 'aus Mulm u. Moos' (BMNH; USNM).

PUEBLOTHRIPS Stannard

Pueblothrips Stannard, 1950 : 143–145. Type-species: *Pueblothrips minuta* Stannard, by original designation and monotypy.

Priesner (1960) included this genus in the Williamsiellina on the grounds that the maxillary stylets are restricted to the mouth cone and the tube is short. However, the median abdominal tergites each bear 2 pairs of wing-retaining setae, the forewings have about four duplicated cilia, and the third antennal segment bears 3 sense cones. These characteristics suggest that *Pueblothrips* is not related to the other genera in this subtribe, but no alternative relationship can be suggested at present.

Pueblothrips minuta Stannard

Pueblothrips minuta Stannard, 1950 : 145–146. Holotype ♂, MEXICO (INHS) [not examined].

This species, which is the only species in the genus, was apparently collected from ground litter.

MATERIAL STUDIED. MEXICO: Hueytamalco, Puebla, 1 ♀ paratype, 30.xii.1945 (*Alvarez*) (USNM). U.S.A.: Florida, taken in quarantine at Brownsville, 1 ♂ on orchid flower, 17.v.1937 (*Singleton*) (USNM).

SOPHIKOTHRIPS Mound

Sophikothrips Mound, 1970 : 113–114. Type-species: *Sophikothrips malaitae* Mound, by original designation and monotypy.

The only species in this genus is known from a single macropterous female collected in the Solomon Islands. This specimen bears a superficial similarity to members of the *Sophiothrips* group in having a small head, broad pronotum and a small tube. Moreover the forewings have no duplicated cilia and the median abdominal tergites only bear one pair of wing-retaining setae. However, the maxillary stylets appear to be longer than in any other member of the Williamsiellina, and the antennal sense cone formula (3 on III; 4 on IV) is not found in other species in this group.

Sophikothrips malaitae Mound

Sophikothrips malaitae Mound, 1970 : 114. Holotype ♀, SOLOMON ISLANDS (BMNH) [examined].

MATERIAL STUDIED. Holotype ♀ macroptera, SOLOMON ISLANDS: Malaita, in leaf litter, 24.i.1965 (*Greenslade*) (BMNH).

SOPHIOTHRIPS Hood

Sophiothrips Hood, 1933 : 425–426. Type-species: *Sophiothrips squamosus* Hood, by original designation.

This genus is exceptionally difficult to understand at present, partly because of the magnitude of the intraspecific variation between sexes and morphs and partly because of the lack of material on which to base a knowledge of interspecific variation. It must be stressed that the key to species given below applies only to the type-series of the six species. In the Hood collection at the USNM there are a further 3 ♂, 14 ♀ of doubtful identity which are intermediate between several of the nominal species. These specimens may represent further undescribed species, or, particularly as

they were collected with one or more of the described species, they may indicate that some of the nominal species are synonyms.

Unfortunately several species are known only from one or two morphs, or even from one sex. The shape of the head (Figs 7–9) and the colour of the legs is usually different between the sexes, but the unique holotype of *comptus*, a macropterous female, is very 'masculine' in appearance. In *politus* the terminal setae on tergite IX are shorter than the tube in the female but longer than the tube in the male. Moreover the metanotal setae are elongate in the male. Similarly the praepectus is usually present in males and absent in females, but this structure is present in the females of *panamensis*. The body surface is strongly sculptured in *squamosus* and *verrucosus* but is almost smooth in *panamensis*. However, in *spadix* the micropterae have no sculpture on the fore femora whereas the macropterae are weakly sculptured. All the morphs of each of the species in the genus have 2 sense cones on segments III and IV, but in macropterae these are long and curved whereas in micropterae they are short and straight. The macropterae have only 1 pair of tergal wing-retaining setae, and the wing lobes of the female micropterae are very small, each bearing one or two setae. The median abdominal sternites are considerably longer then the tergites and none of the males has a sternal glandular area. In *spadix* the male has a stout tubercle medially on the posterior margin of tergite IX, and the male of *verrucosus* has a small lobe in this position. However, the males of *politus* and *squamosus* lack all trace of this structure.

Key to species

1 Antennal segment II dark brown, at least at base; fore femora strongly sculptured 2
– Antennal segment II yellow to yellowish brown; fore femora usually without sculpture, sometimes weakly sculptured in ♀ macropterae 4
2 Tube brown; interocellar and lateral postocular setae short, scarcely twice as long as diameter of one eye facet; only ♀ apterae known [Brazil] . . . . . **verrucosus** (p. 189)
– Tube yellow or golden brown with apical constricted band dark brown; interocellar setae 3–5 times as long as diameter of one eye facet 3
3 Antennal segments III–VIII dark brown, extreme base of III and IV yellow; interocellar setae exceptionally long (62 μm); hind femora, tibiae and tarsi brown [Brazil] . **comptus** (p. 187)
– Antennal segments III–VI bicoloured, III yellow at apex as well as extreme base; interocellar setae about 20 μm; hind femora yellow at apex, tibiae brown, tarsi pale [Panama] . . . . **squamosus** (p. 188)
4 Median area of metanotum not sculptured [♂ unknown] [Panama] . . **panamensis** (p. 187)
– Median area of metanotum sculptured 5
5 Macropterous ♀ with tube yellow medially, brown at base and apex; ♂ with median tubercle on posterior margin of tergite IX [U.S.A.: Florida] . . . . . . **spadix** (p. 188)
– Macropterous ♀ with tube golden yellow basally, apical sixth dark brown; ♂ without a tubercle on tergite IX [Brazil] . . . . **politus** (p. 188)

Sophiothrips comptus Hood

Sophiothrips comptus Hood, 1956 : 69–72, fig. 154. Holotype ♀, Brazil (USNM) [examined].

The unique holotype of this species is exceptionally large and brightly coloured. The cheeks are strongly swollen, as is typical of males in this genus, but the postocular setae are scarcely one-third as long as the postocellar setae.

Material studied. Holotype ♀ macroptera, Brazil: Santa Catarina State, Nova Teutonia, ii.1950 (*Plaumann*) (USNM).

Sophiothrips panamensis Hood

Sophiothrips panamensis Hood, 1933 : 428–429. Holotype ♀, Panama (USNM) [examined].

This species is known from three females which appear to have been collected together with *S. squamosus*. These females are particularly lacking in sculpture.

MATERIAL STUDIED. Holotype ♀ macroptera, PANAMA: Porto Bello, from dead vegetation, 10.vii. 1933 (*Hood*) (USNM).

PANAMA: 1 ♀ macroptera, 1 ♀ microptera paratypes with same data as holotype (USNM).

Sophiothrips politus Hood

Sophiothrips politus Hood, 1956 : 72–75, fig. 155. Holotype ♀, BRAZIL (USNM) [examined].

This relatively weakly sculptured species was described from three females and one male collected at Belem and one female collected in Georgetown, Guyana. However, there is one macropterous female from Trinidad in Hood's collection which has the colour and lack of sculpture of *politus* but has a heavy looking tube as occurs in *squamosus*. Moreover there is also one macropterous female which was collected with the *politus* type-series and generally looks like that species, but has the pronotum and fore femora sculptured as in *squamosus* and has antennal segments III–VI dark brown not bicoloured. These specimens either represent two further species or they may indicate that the sculpture and body colour are variable in some species of this genus.

MATERIAL STUDIED. Holotype ♀ macroptera, BRAZIL: Para State, Belem, from dead *Hevea* branches, 26.vii.1951 (*Hood*) (USNM).

BRAZIL: 1 ♀ macroptera, 1 ♂ microptera paratypes with same data as holotype; 1 ♀ macroptera with similar data but 4.viii.1951 (USNM).

Sophiothrips spadix Hood
(Figs 7–9, 23, 24, 41, 42)

Sophiothrips spadix Hood, 1954*a* : 282–283. Holotype ♀, U.S.A.: Florida (USNM) [examined].

The differences between the morphs are very considerable in this species. The antennae of the macropterae are similar to those of *comptus* and *squamosus*, but the sense cones on the micropterae are much shorter (Figs 41, 42). The head of the macropterae is similar to that of *politus* although more constricted to the base, but the head of the male is elongate with long setae. In Hood's collection there is one male from Miami, Florida, which looks like *spadix* but which lacks the tubercle on the posterior margin of the ninth tergite.

MATERIAL STUDIED. Holotype ♀ macroptera, U.S.A.: Florida, Gainesville, collected from dead oak branches, 13.vi.1954 (*Hood*) (USNM).

U.S.A.: 11 ♀ macropterae, 18 ♀ micropterae, 6 ♂ micropterae paratypes with same data as holotype (USNM).

Sophiothrips squamosus Hood

Sophiothrips squamosus Hood, 1933 : 426–428. Holotype ♀, PANAMA (USNM) [examined].
Sophiothrips squamosus Hood; Hood, 1950: 41, figs 67–71.

Some of the specimens in the type-series of *squamosus* bear the same Hood number (989) as the types of *panamensis*, which suggests that these species were collected together. They appear to be quite distinct from each other since *squamosus* is heavily sculptured whereas *panamensis* has very weak sculpture markings. However, one male in the Hood collection, which bears the same date and locality as the types but has the Hood number 988, is very similar to a large male *squamosus* except that the fore femora are almost unsculptured and the pronotal anteroangular setae are as long as the basal width of the head. Hood (1950) recorded *squamosus* from Cuba and Brazil, but later (1954) described the Brazilian specimens as *verrucosus*.

MATERIAL STUDIED. Holotype ♀ macroptera, PANAMA: Porto Bello, from dead vegetation, 10.vii. 1933 (*Hood*) (USNM).

PANAMA: 1 ♀ macroptera, 3 ♀ micropterae, 4 ♂ micropterae paratypes with same data as holotype; 1 ♂ paratype with similar data except 9.vii.1933; 1 ♂ macroptera, Barro Colorado Island, 6.viii.1933 (USNM).

Sophiothrips verrucosus Hood

Sophiothrips verrucosus Hood, 1956 : 75–77, figs 156–157. Holotype ♀, BRAZIL (USNM) [examined].

This species is very similar to *squamosus* with which it was originally misidentified (Hood, 1950 : 41). However, the body colour is darker and the sculpture differs in detail. There is one female in the Hood collection from Brazil, Jacarepagua, 28.vi.1948, which is similar in colour to *verrucosus* but lacks the complex structure.

MATERIAL STUDIED. Holotype ♀ microptera, BRAZIL: Distrito Federal, Jacarepagua, from dead branches, 21.vi.1948 (Hood & Borgmeier) (USNM).

BRAZIL: 2 ♀, 1 ♂ paratypes with similar data, 9.v.1948 (USNM).

WILLIAMSIELLA Hood

Williamsiella Hood, 1925 : 60. Type-species: *Williamsiella bicoloripes* Hood, by original designation and monotypy.

Apterous; head with postocular setae elongate and arising far apart, ocellar and cheek setae very small; cheeks straight, converging to base of head; eyes with only 7 or 8 facets. Antennal segment III relatively small but slender with no sense cones, VI slender, VII and VIII fused. Prothorax with epimeral sutures exceptionally short; anteromarginal, anteroangular and midlateral setae very short, epimeral setae very long, posteroangular setae variable; praepectal plates weakly indicated by large shaded areas formed from fused chitinous islets. Fore tarsus unarmed in both sexes. Meso- and metathoracic furcae fused into an inverted U-shape with extensions to coxal cavities and a slender median spinula. Pelta arched away from tergite II; sternites III–V much longer than tergites, IV and V with 8–10 median accessory setae; tergite IX with B_1 setae longer than tube.

Williamsiella bicoloripes Hood

(Figs 14, 26, 36)

Williamsiella bicoloripes Hood, 1925 : 60–61. Holotype ♀, TRINIDAD (USNM) [examined].

This species resembles *Phthirothrips* species in the epimeral sutures and setae on tergite IX, but has different antennae and thoracic chaetotaxy. The body colour is quite distinctive in that it is mainly brown to dark brown with antennal segment II and the distal extremities of the femora pale. The setae on tergite IX are paler and more slender than the other major setae. It is significant that this, the most widespread and common species of the Williamsiellina, should be placed in a monobasic genus. However, despite its distribution no macropterae are known. The species is usually found on dead branches where it apparently feeds on the fungal component of lichens. This is deduced from the fact that the hind gut usually contains large amounts of green pigment apparently from undigested algal cells.

MATERIAL STUDIED. Holotype ♀, TRINIDAD: Arima, Verdant Vale, beaten from faggots, 12.viii.1917 (*C. B. Williams*) (USNM).

TRINIDAD: 1 ♂, 1 ♀ paratypes with same data as holotype (USNM); El Tucuche, 1 ♀ on dead branches, vi.1951 (USNM); Simla, 3 ♂ on dead wood, xi.1970, and Aripo, 5 ♀, 1 ♂, 9 larvae II on *Hibiscus* branch with lichen and moss, xi.1970 (*L. A. Mound*) (BMNH). BRAZIL: São Paulo State, Boracea, Salesopolis, 9 ♀, 1 ♂, vi.1948; Santa Catarina State, Nova Teutonia, 23 ♀, i–v.1949; Rio de Janeiro State, Petropolis, 10 ♀, v–vi.1948 (USNM). U.S.A.: Florida, Palmdale, 6 ♀, 1 ♂ on dead bracken, iii.1938; F., Torreya State Park, 7 ♀, 3 ♂ on dead branches, xii.1938; Texas; Pledger, 4 ♀, 1 ♂ on dead branches, i & iv.1939; T., Angleton, 1 ♀, iii.1939 (USNM).

ZAXENOTHRIPS Crawford

Zaxenothrips Crawford, 1943 : 221–224. Type-species: *Zaxenothrips peculiaris* Crawford, by original designation and monotypy.

Head strongly transverse except in major ♂; 3 pairs of postocular setae, median 2 pairs shorter than lateral pair. Antennae 8-segmented, VII and VIII closely joined, VI enlarged; III with 1 sense cone, IV with 2 sense cones. Pronotum transverse, except in major ♂, epimeral sutures complete; major setae not elongate; praepectus usually very small and weak, mesopraesternum absent. Pterothorax strongly transverse with mesothoracic spiracles protruding. Pelta reduced to an arch, distant from anterior margin of tergite II; tergites III and IV much shorter medially than sternites; setae on tergite IX shorter than tube, B_2 in ♀ shorter and stouter than B_1. Tube short and stout with short terminal setae; ♂ without a median tooth on tergite IX.

The three species here included in this genus are very similar to each other. Although they were described in different genera there is a possibility that they represent variants of a single species. The antennae are very similar to those of *Nanothrips* species, but the pelta is different.

Key to species

1 Antennal segment II brown; segments III–VII strongly bicoloured, brown in distal half but yellow at base [U.S.A.: Maryland, Illinois] . . . . . . ***peculiaris*** (p. 190)
– Antennal segment II yellow, III–VII pale or weakly bicoloured 2
2 Fore tarsal tooth present in ♀; lateral postocular setae at least 20 μm, about twice as long as diameter of one eye facet [U.S.A.: Texas, Florida] . . . . . ***unicolor*** (p. 190)
– Fore tarsal tooth absent in ♀; lateral postocular setae 16 μm, shorter than the diameter of one eye facet [U.S.A.: Florida] . . . . ***vorticosus*** (p. 190)

Zaxenothrips peculiaris Crawford

(Figs 10, 11, 25)

Zaxenothrips peculiaris Crawford, 1943 : 224–225. Holotype ♀, U.S.A.: Maryland (USNM) [examined].

The major males of this species have a longer head than the females and minor males, and the pronotum and forelegs are considerably enlarged. This species may represent a darker northern form of *unicolor*.

MATERIAL STUDIED. Holotype ♀, U.S.A.: Maryland, Bethesda, under hickory bark, 18.viii.1940 (*J. C. Crawford*) (USNM).

U.S.A.: 2 ♀, 1 ♂ aptera, 1 ♀ macroptera paratypes with same data as holotype (USNM with 1 ♀ BMNH); Illinois, Hardin City, 2 ♀, 1 ♂ on dead wood, 9.x.1970 (*L. A. Mound*) (BMNH).

Zaxenothrips unicolor (Hood) **comb. n.**

(Fig. 35)

Sophiothrips unicolor Hood, 1939 : 597–600. Holotype ♀, U.S.A.: Texas (USNM) [examined].

The specimens listed below from Florida have shorter postocular setae than the type-specimens from Texas.

MATERIAL STUDIED. Holotype ♀, U.S.A.: Texas, Palacios, on dead branches, 19.xii.1938 (*Hood*).

U.S.A.: 10 ♀, 2 ♂ paratypes with similar data, xii.1938 – iv.1939 (USNM, with 1 ♀ BMNH); Florida, Sea Horse Key, 11 ♀, 1 ♂ on dead branch, 13.vii.1954 (*Hood*) (USNM, with 1 ♀ AMG).

Zaxenothrips vorticosus (Hood) **comb. n.**

Sophiothrips vorticosus Hood, 1954*a* : 283–284. Holotype ♀, U.S.A.: Florida (USNM) [examined].

This species and *unicolor* differ from *Sophiothrips* species in the form of the pelta and in the shortness of the sense cones on the antennae.

MATERIAL STUDIED. Holotype ♀, U.S.A.: Florida, Homestead, on dead branches, 22.vii.1940 (USNM).

U.S.A.: 1 ♀ paratype with similar data but 6.iv.1938 (*Bradley*) (USNM).

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A revision of the New Guinea weevil genus *Apirocalus* Pascoe (Coleoptera: Curculionidae)

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Contents

Synopsis

Thirty-four species and nine subspecies are described and included in a key. Twenty-nine of the species and all the subspecies are new. The species are arranged in eleven groups, two of which are placed in a new subgenus. The types of the six previously described species have been examined and one lectotype designated; one of the six is promoted from varietal status and another is transferred to a new genus. To this new genus is added a second species from a genus the (homonymous) name of which is replaced. The biology, distribution and economic importance of the species are discussed. Variation in the length of the flagellum is introduced as a character for separating closely related species. Examples of structural variation in response to factors related to altitude are noted.

Introduction

The need for the present revision became apparent when it was discovered that the series of *Apirocalus cornutus* in the collection of the Department of Agriculture, Stock and Fisheries, Port Moresby, included a number of other species of this genus (and some of other genera), several of which were undescribed. The incentive to make the revision was provided by Dr J. J. H. Szent-Ivany, former Senior Entomologist, DAPM, who wished to include this material in his *Economic insects of Papua New Guinea* (in press).

Depositories

AMNH American Museum of Natural History, New York.
ANIC [Australian National Insect Collection,] Division of Entomology, CSIRO, Canberra.
BMNH British Museum (Natural History), London.

Bull. Br. Mus. nat. Hist. (Ent.) **36** (5): 193-280 Issued 22 December 1977

BPBM	Bernice P. Bishop Museum, Honolulu.
CAS	California Academy of Science, San Francisco.
CWO'B	Dr C. W. O'Brien, Tallahassee, Florida.
DAPM	Department of Agriculture, Stock and Fisheries, Konedobu, Port Moresby.
DFB	Department of Forests, Bulolo, Papua, New Guinea.
FMNH	Field Museum of Natural History, Chicago.
IP	Institut für Pflanzenschutzforschung, Eberswalde (formerly Deutsches Entomologisches Institut).
MCZ	Museum of Comparative Zoology, Harvard University, Boston.
MGF	Museum G. Frey, Tutzing, Munich.
MNHN	Muséum national d'Histoire naturelle, Paris.
NMNH	National Museum of Natural History, Washington (formerly United States National Museum).
NMV	National Museum of Victoria, Melbourne.
RNH	Rijksmuseum van Natuurlijke Historie, Leiden.
RWH	Dr R. W. Hornabrook, Wellington.
SAM	South Australian Museum, Adelaide.
SMT	Staatliches Museum für Tierkunde, Dresden.
TM	Természettudományi Múzeum, Budapest.

Biology and economic importance

Species of *Apirocalus* have been found in primary and secondary rainforest, grassland, native gardens and plantations of all kinds. They appear, however, to avoid marshy areas (Maps 1, 8). Some of the smaller species have been found on the ground, in leaf litter and in rotting vegetation. Adults have been found on, and often attacking, a very wide range of flowering plants including herbs, shrubs and trees (Szent-Ivany, 1958 : 435). Their main economic importance arises from their habit of attacking the tender terminal shoots of shrub crops, such as tea and coffee and those of tree seedlings, such as cacao and rubber. Other crops attacked include cotton, rice, maize, banana, taro, soya bean, cowpea, Brussels sprouts and ripe strawberries (see Plant index, p. 279). They have also been found on hoop and Klinki pines (Coniferae, Araucariaceae). Gray & Wylie (1974 : 74) describe damage caused to hoop pine seedlings by caged adults of *A. ebrius*. They have not been found on any cryptogamic plants, although fern sporangia have been observed attached to several specimens. Flowers are sometimes eaten; *A. ebrius* was found attacking banana flowers at Madang (Szent-Ivany & Barrett, 1956 : 41) and pollen was found in the hind-gut of a specimen of *A. cornutus tenuiscapus* from Mt St Mary. This consisted mainly of large spiny grains of a malvaceous plant (*Hibiscus*, *Abelmoschus* or possibly *Thespesia*) with some smaller grains of Amaranthaceae, probably *Gomphrena*.

The immature stages are unknown but, by analogy with other otiorhynchines, the larvae are probably root-feeders. Gravid females have been found to contain 20–30 smooth, oval or oblong whitish eggs.

Common names: 'coffee shoot weevil' (Simmonds, 1960); 'grey weevils' (Simon Thomas & Verloop, 1962).

Parasites and predators

Diptera

A remarkable tachinid (?) larva was found in a female of *A. ebrius* from Budemu, Finisterre Range. The posterior spiracles are enormously enlarged, reminiscent of those of a tsetse fly larva but more dorsally situated. This larva bears no resemblance to any known tachinid parasites of other otiorhynchine weevils and none has yet been reared from the Celeuthetini. A first instar tachiniform larva was found in a male of *A. sedlaceki* from Nami Creek (near Wau) and a second instar larva came from a male of *A. fallax* from Perumeva (near Tapini). All three larvae have been described by K. G. V. Smith in a manuscript that will go to press when this revision has been published.

Hymenoptera

A small larva, possibly belonging to the Proctotrupidae, was found in a male of *A. mus* from the Singuawa River (near Lae). A larger larva was found in a female of *A. stellifer* from Okasa (near Okapa) and three large larvae almost filled the abdomen of a male *A. olivaceus* from Mt Giluwe.

Strepsiptera

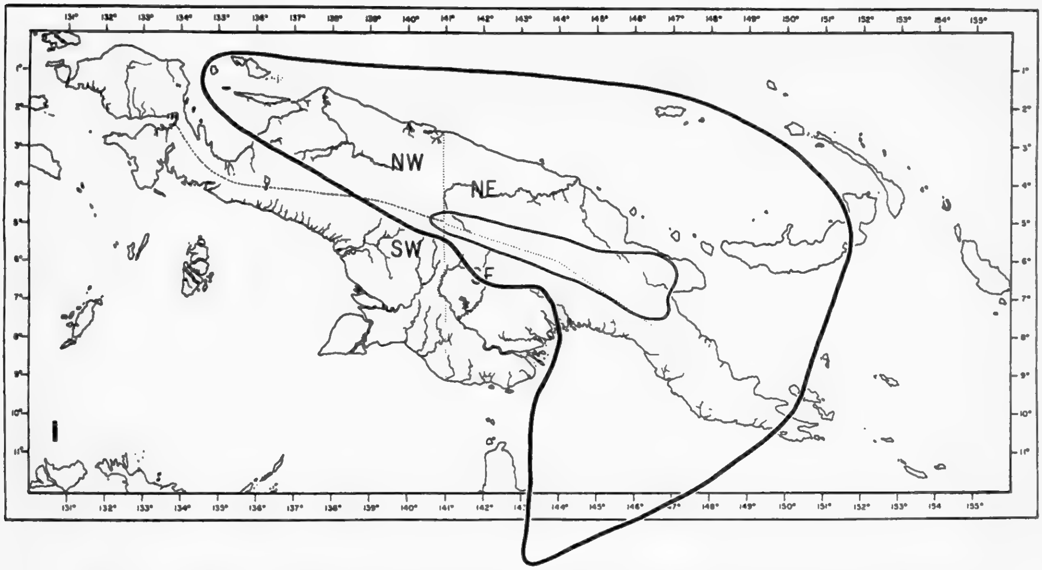
A specimen, probably of *A. e. ebrius* (recorded as *cornutus*) from Aiyura has been reported with 'a possible strepsipteron' protruding from the abdomen (Simmonds, 1960 : 54).

Acarina

Larvae of erythraeid mites of the genus *Leptus* (=*Achorolophus*) have been found attached to specimens of *A. a. avus*, *A. atrigenua*, *A. hydrographicus* and *A. e. ebrius*, among others.

Aves

The hind-bodies of two male specimens of *A.* sp., ? *sedlaceki* were recovered from the stomach of a small honeyeater, *Myzomela rosenbergi* Schlegel (Aves, Meliphagidae), at Wau (specimens in MCZ).



Map 1 Range of *Apirocalus* (outer loop); range of subgenus *Molobrium* (inner loop).

Distribution

Map 1 shows the established range of the genus. The two major lowland species (*cornutus* and *ebrius*) have populations on certain off-shore islands, New Britain, Manus I. and Cape York. These differ slightly from their mainland counterparts and thus appear to be of long standing. Records of *A. ebrius* from further afield (Solomons, Philippines) must, if genuine, be the result of recent introductions. It is an interesting fact that the two largest species both occur (at about 1500 m) on off-shore islands (*A. hornabrooki* on Karkar I. and *A. ater* on Goodenough I.).

Although the members of each species-group are usually strictly allopatric, those of two, or even three different groups may occur together, e.g. *A. cornutus tenuiscapus*, *A. canus* and *A. fallax* in the upper part of the Alabule river valley (Central District, Goilala Subdistrict); *A. ebrius wagneri*, *A. avus finisterrae* and *A. gracilis* in the hills above Saidor (Finisterre Range, northern Morobe District).

The species of *Apirocalus* show marked differences in their vertical distribution. Most belong in Group III of Szent-Ivany's classification (1200*–2400 m) (Szent-Ivany, 1965 : 20) though the ranges of several descend to 1000 m and some to 700 m while that of *A. avus intermedius* rises to 2700 m. *A. bacchusi* and *A. strigifrons* are known only from 2700 m and 2800 m respectively. *A. hydrographicus* and *A. cornutus virescens* have distinctly lower ranges at 300–1300 m and 400–1700 m respectively, while *A. olivaceus* has a higher one at 2200–3900 m. *A. cornutus tenuiscapus* seems anomalous with a range of 600–2550 m but consists of two local forms which occur at different altitudes. Of the lowland species, *A. mus* and *A. c. cornutus* belong in Group I (0–900 m) while *A. e. ebrius* appears to belong in Group II (0–2200 m) though this subspecies also consists of numerous ± distinct local forms which occur at various altitudes.

Descriptions of genera

APIROCALUS Pascoe

Apirocalus Pascoe, 1881 : 590. Type-species: *Apirocalus cornutus* Pascoe, by monotypy.

Celeuthetine Curculionidae (*sensu* Marshall, 1956 : 5) with dorsal surface of rostrum as broad at base as between antennal insertions, or broader, smoothly and increasingly declivous towards apex, the sloping area strongly and irregularly punctured and devoid of scales; scrobes open posteriorly; base of rostrum level with frons; rostro-frontal furrow angulate, usually very deep (except in mid-line); antennal funicle segment 1 ≏ or < 2 and hind tarsi with segment 2 = or < 3; head not constricted behind eyes; scutellum obsolete; metepisternal suture incomplete posteriorly; femora and tibiae unarmed.

All the species of *Apirocalus* have a single pair of dorsal elytral tubercles or processes, sometimes accompanied by much smaller accessory granules or swellings. Some unrelated genera have very similar elytral processes but in these the rostrum is abruptly declivous towards the apex; to distinguish *Apirocalus* it is therefore essential to check the rostrum. In *Apirocalus* there are four principal setae on the mentum, a larger outer pair and a smaller inner pair. These are accompanied by 0–4 smaller setae which are often irregularly arranged. Similarly, each mandible has 5 or 6 large setae and 2–4 smaller ones.

A remarkable feature of *Apirocalus* is the great variation shown by the antennal scape (Figs 4–15); several species-groups can be recognized from this structure alone. The 10 elytral striae may be grossly distorted or even interrupted by the elytral processes; stria 10 is complete but greatly attenuated behind the level of the hind coxae. The trochanters lack the single large seta which so many genera have; both coxae and trochanters are normally devoid of scales but the fore coxae bear scales in some lowland species. The arms of the mesosternum and the mesepisterna may, or may not, bear scales.

Both sexes almost certainly occur in all the species, though three are presently known from females only. The ♂ : ♀ ratio usually approaches 1 : 1 but in *A. avus intermedius* it is 1 : 2 (in 35 ex.) and in *A. stellifer* it is 3·2 : 1 (in 25 ex.). The elytral processes of the male are frequently longer than those of the female and often differently shaped. In *A. acutus* the fore femora and antennal funicle are also dimorphic. In the *cornutus*-group, dimorphism occurs affecting the rims of the rostral pterygia. In the males, these are microsculptured (as they are in both sexes throughout the rest of the genus) but in the females of this group they are smooth and highly polished (Fig. 244). These females are also usually distinguished by having a number of large erect setae at the postero-ventral margin of the prothorax (Fig. 243).

The genitalia are shown in Figs 74–78. The genital tract is very elongate in both sexes. The ovipositor is capable of considerable extrusion (up to × 0·7 body-length). A flagellum is normally present in the male; its length varies greatly between the species and this variation is reflected in the length of the spermathecal duct of the female. The latter opens proximally on a spout in a subspherical chamber at the distal end of the bursa copulatrix (Fig. 82). The oviduct opens into the bursa immediately below this chamber. The ovipositor valves and their setae (Fig. 83) are remarkably constant throughout the genus but the proportions of the styli vary.

* The lower limit, 4700 ft, has been changed to 4000 ft in a copy of this paper received from the author.

Apirocalus is one of seven genera separated by Marshall (1956 : 9) because the apex of the rostrum is not abruptly declivous dorsally. Of these, four (*Acoptorrhynchus* Heller, *Oedirrhynchus* Marshall, *Idorhynchus* Faust and *Pachyrhynchidius* Faust) are monotypic and of uncertain affinities. Despite marked superficial differences, the remaining three form a close-knit group; they may be separated by the following provisional key.

1 Antennal scape shorter than pronotum and segment 2 of hind tarsus shorter than 3 but if, in either case, equal in length, then pronotum strongly granulate 2

– Antennal scape longer than pronotum and segment 2 of hind tarsus longer than 3 but if, in either case, equal in length, then pronotum without granules.
Scales pale green . . . . **HELLERRHINUS**

2 Pronotum smooth, with a broad median sulcus. Dorsum bare or with a few very thinly scattered scales. Sides of prothorax with very fine and sparse punctures. Antennal funicle segment 1 usually slightly longer than 2; club not, or very slightly, wider than funicle **KOKODANUS**

– Pronotum rough, uneven or granulate, sometimes depressed but without a median sulcus. Dorsum with numerous, often very dense, scales. Sides of prothorax with large dense punctures or rugae (often concealed by scales). Antennal funicle segment 1 usually shorter than 2; club distinctly wider than funicle . . . . **APIROCALUS**

The *nivosus*- and *olivaceus*-groups of *Apirocalus* show some affinity with *Hellerrhinus* while *H. bispinosus* Marshall links *Hellerrhinus* and *Kokodanus*; an undescribed species of *Kokodanus* provides a reciprocal link with *Hellerrhinus*.

Methods

Since the genitalia of both sexes extend into the thorax, it was necessary to remove the entire abdomen (having first softened the specimen in warm water). The suture between the metasternum and venter is long, straight and partly fused, so that considerable force was required to open it (even with a scalpel). Once free, the venter was pulled carefully backwards until the gut and tergites parted, leaving the genitalia intact. The whole abdomen was then cleared with potash before further dissection. After dissection, the transparent parts of the genitalia were stained with chlorazol black (in very dilute solution). Any drawings of delicate or enclosed structures were made at this stage before transfer to glycerine for storage. Most of the preparations were placed in glass microvials fitted with corks but some plastic vials were also used.

Measurements were normally made directly, using an eye-piece scale but the flagellum and spermathecal duct were first sketched, using a camera lucida, and the drawing then measured with dividers set to the equivalent of 0·1 mm.

The dissected specimens were mounted on an upward-curving card point, inserted from behind into the thorax with the venter, inverted, on a separate point below. This method obviates the difficulties inherent in attempting to pin, or re-pin, a specimen from which the abdomen has been removed and at the same time allows the entire external anatomy of the specimen to be examined.

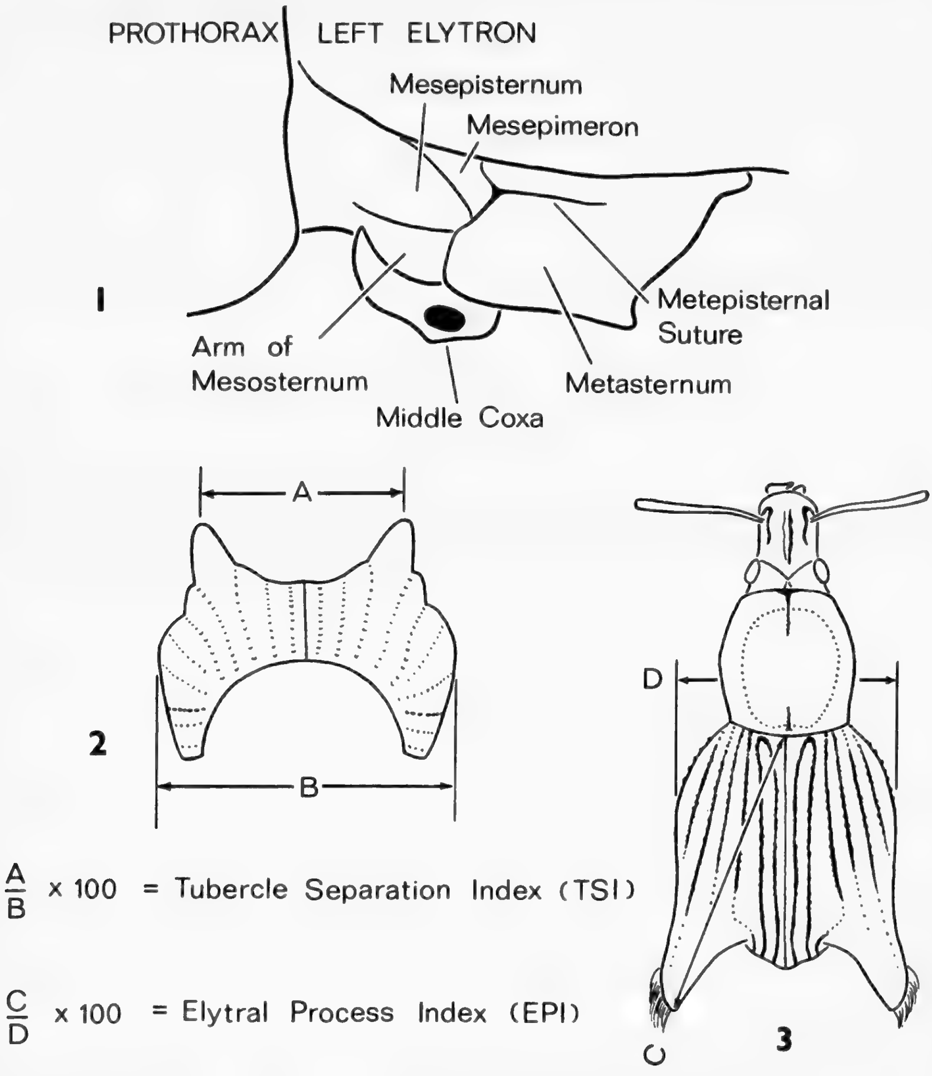
Identification

In preparing the key, I have used external characters as far as possible. Where it has proved necessary to add internal characters, these are always given after the externals. Sexual dimorphism and other forms of variation are allowed for by bringing out the same species at several places. Hence, if the characters of a specimen seem ambiguous at a certain point in the key, it is likely that either alternative will lead to a correct exit. Since the ranges of most species are very limited, reference to the appropriate description will usually indicate immediately whether or not the determination is correct.

The dearth of strong external characters has prevented me from making a workable key to the species-groups; these are shown in the check-list on p. 206 and their characters are given on the pages there indicated.

The terminology used is as in my earlier paper (Thompson, 1968 : 366) except that I have frequently been obliged to refer to the claw-segment of the tarsus as 'segment 5'; it needs to be

remembered that segment 4 is here concealed between the lobes of segment 3, as in most Curculionidae.



Figs 1–3 1, Thorax of *Apirocalus* in side view (drawn from a female of *A. paradoxus*). 2, *Apirocalus* (*Molobrium*) *gracilis*, elytra of male in antero-dorsal view. 3, *Apirocalus* (*A.*) *olivaceus*, male.

As it is impossible to make accurate measurements of the elytral processes, I have used instead the two indices shown in Figs 2 and 3. It is important to note that the EPI does not necessarily reflect the length of the processes; *A. nivosus* and *A. atrigenua* have similar EPIs but the latter has much longer processes than the former (but shorter elytra). Obviously, steeply rising processes contribute little to the longitudinal measurement. Various dimensions (especially of the male genitalia) are compared, not only to each other but also to the length of the pronotum. The latter is one of the few dimensions capable of accurate measurement and is thus a better standard of size than the overall length.

Key to the subgenera, species and subspecies

1 Elytra, at top of declivity, with a pair of setiferous tubercles or straight tapering subisodiametric processes, centred on interstriae 3 and/or 4, rising steeply and not, or weakly, diverging (Fig. 2), lying entirely within elytral outline (viewed from above) or with only their apices projecting beyond it. Length < 7 mm. (Subgenus *Molobrium* subgen. n.) 2

– Elytra, at top of declivity, with a pair of angulate or blade-like (Fig. 3) or curved processes, centred on interstriae 5 and/or 6, usually subhorizontal or weakly rising (very short and obtuse in some cases); if steeply rising or subisodiametric, then either strongly diverging or body-length > 7 mm and processes projecting well beyond elytral outline. (Subgenus *Apirocalus* Pascoe) 8

2 (1) Mesepisterna with very small ill-defined punctures and no scales. Median lobe of aedeagus $> \times 3$ as long as broad 3

– Mesepisterna with large deep well defined punctures and (usually) some scales. Median lobe of aedeagus $< \times 3$ as long as broad 4

3 (2) Prothorax as long as or slightly longer than broad; sides ± evenly rounded. Each elytral process simple (♂) or with a much smaller accessory tubercle close against its outer side (♀). Male with disc of metasternum flat and disc of ventrite 1 without any carinae. Scales on body greenish . . . . ***gracilis*** sp. n. (p. 207)

– Prothorax slightly broader than long; sides strongly rounded in middle, tapering strongly and ± evenly to both base and apex. Each elytral process (in ♂) with two accessory tubercles (Fig. 31) (♀ unknown). Male with disc of metasternum convex and ventrite 1 with a pair of longitudinal carinae, separated by a distance about equal to length of ventrite 4 . . . . ***stibicki*** sp. n. (p. 209)

4 (2) Elytral tubercles without any smaller accessory tubercles; adjacent interstriae on outer side of tubercles not strongly convex. Posterior half of mesepisterna covered with scales which are at least as large as those on metasternum and elytra. Upperside of elytra (except disc) covered with erect, almost straight setae, of equal length-range throughout, the longest at least as long as greatest diameter of antennal scape (Fig. 30). Median lobe of aedeagus $\times 2{\cdot}5$ as long as broad and with a pair of admedian dorsal carinae which project apicad over edge of phallotreme (Fig. 92) . . . . ***io*** sp. n. (p. 209)

– Elytral tubercles either with a much smaller accessory tubercle on outer side or the two adjacent interstriae convex or costate but, if simple, then either mesepisterna with only a few small scales or elytral setae semi-erect and shorter than greatest diameter of scape. Median lobe of aedeagus $< \times 2{\cdot}4$ as long as broad; dorsal carinae, if present, not projecting apicad 5

5 (4) Sections of elytral interstriae 5 and 6 adjacent to tubercles usually convex or costate (best seen in antero-dorsal view) but not forming discrete tubercles. Scales on mesepisterna numerous (15–50) and as large, or almost as large, as those on elytra. Ventrite 1 of ♂ without, or with a narrow median sulcus ($<$ half width of intercoxal process). Median lobe of aedeagus with no trace of dorsal carinae 6

– Sections of elytral interstriae 5 and 6 adjacent to tubercles not, or weakly convex; interstria 5 with or without a small accessory tubercle. Scales on mesepisterna few (< 15) and smaller than those on elytra. Ventrite 1 of ♂ with wide median sulcus ($>$ half width of intercoxal process). Median lobe of aedeagus with at least some traces of (smooth) dorsal carinae 7

6 (5) Smaller (length $< 5{\cdot}9$ mm). Median lobe of aedeagus $< \times 2{\cdot}2$ as long as broad (Figs 107–110) . . . . ***terrestris terrestris*** subsp. n. (p. 213)

Larger (length $> 5{\cdot}8$ mm). Median lobe of aedeagus $\times 2{\cdot}3$ as long as broad (Figs 111, 112) ***terrestris dissidens*** subsp. n. (p. 213)

7 (5) Base of elytral tubercles extending over interstriae 2–4 with a small accessory tubercle in interstria 5, usually clearly marked off from main tubercle by a cleft in line of stria 5. Sulcus on ventrite 1 of ♂ delimited by longitudinal carinae. Setae near sides of elytra often twice as long as those on femora. Median lobe of aedeagus with well developed dorsal carinae (Figs 94–96); flagellum present . . . . . . ***celatus*** sp. n. (p. 210)

– Base of elytral tubercles extending over interstriae 2–5 with, sometimes, a very small tubercle arising from outer side of each main tubercle (sometimes present on only one of the two main tubercles). Sulcus on ventrite 1 of ♂ ill-defined. Setae near sides of elytra usually less than twice as long as those on femora. Median lobe of aedeagus with only traces of dorsal carinae (Figs 97–99); flagellum absent . ***occultator*** sp. n. (p. 211)

8 (1) Elytral processes subisodiametric, terete, tapering, parallel or only weakly diverging, projecting beyond elytral outline for about half their length (Fig. 234).
Length >7 mm; scales, in part, bright pale green . . . . . ***nivosus*** sp. n. (p. 226)

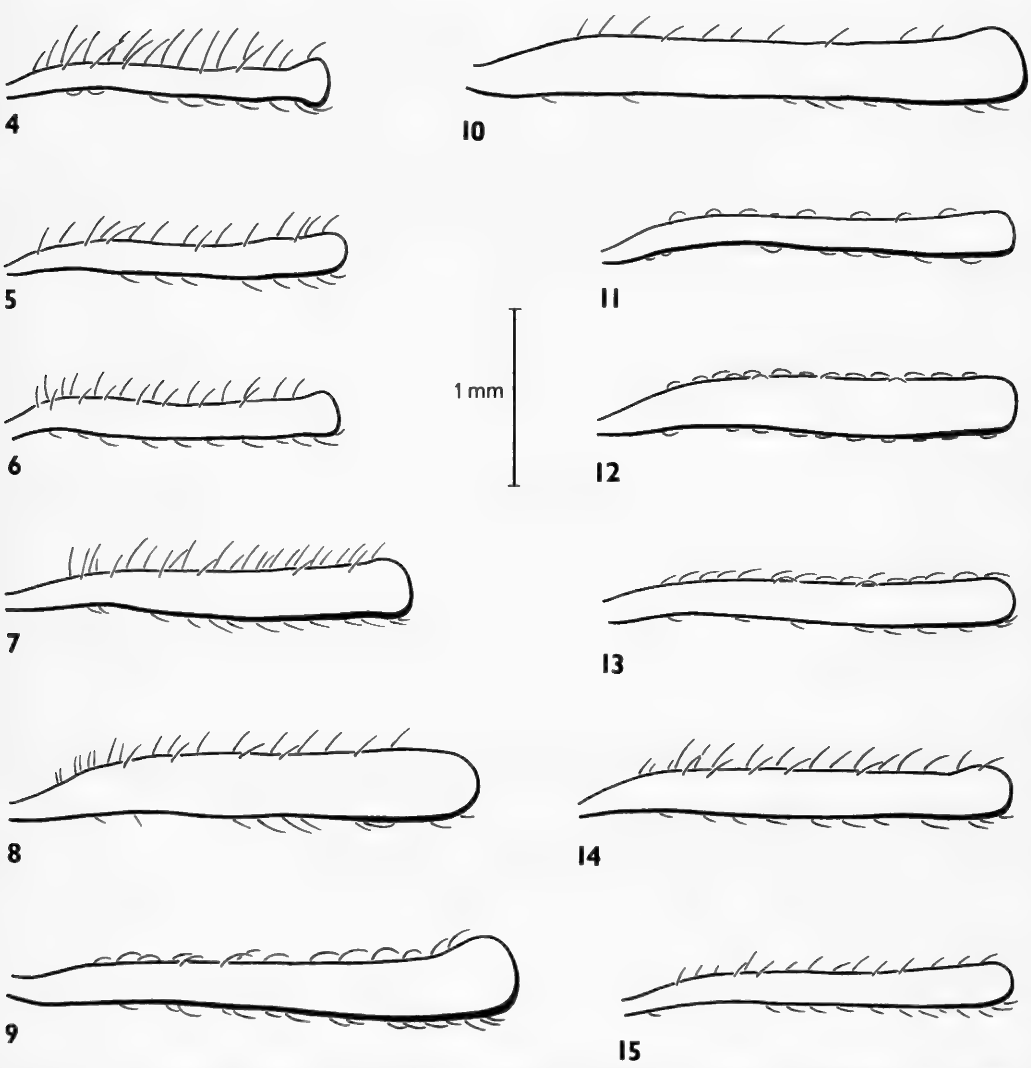
– Elytral processes distinctly diverging or represented by obtuse angulations 9

9 (8) Antennal scape flattened and without any trace of an apical expansion or pre-apical constriction (in dorsal view) (Figs 8, 12); widest point usually within middle two-thirds of length but if at apex (Fig. 13), then setae on leading edge all pale and ± recumbent and disc of pronotum not depressed 45

– Antennal scape slender and terete, or claviform, or flattened and with an apical expansion, often delimited by a pre-apical constriction. 10

10 (9) Antennal scape slender, widening smoothly, evenly and very gradually from near base to apex without any abrupt apical expansion or pre-apical constriction (Figs 11, 15) . 11

– Antennal scape widening more strongly near apex or widening unevenly, with a ± distinct pre-apical constriction or parallel-sided, with a very weak apical expansion (Figs 4, 6, 7, 9, 10, 14) 20



Figs 4–15 Antennal scapes of *Apirocalus* (*A.*) species. 4, *fallax*; 5, *asper*; 6, *sedlaceki*; 7, *nivosus*; 8, *bacchusi*; 9, *hydrographicus*; 10, *ater*; 11, *vexillarius*; 12, *c. cornutus*; 13, *cornutus tenuiscapus*; 14, *ebrius wagneri* (example with expanded apex); 15, *olivaceus*.

11 (10) Granules on disc of pronotum well-defined and larger than those on elytra (near base), their diameter × 3–4 that of surrounding scales. Setae on antennal scape soft, recumbent and inconspicuous, those on fore edge similar to those on hind edge . . . 12

– Granules on disc of pronotum ill-defined, often confused, usually smaller than those on elytra and × 1–3 diameter of surrounding scales. Setae on antennal scape stiff, those on fore edge usually larger and more nearly erect than those on hind edge 13

12 (11) Body with pale lateral stripe. Eyes moderately convex, as in *A. cornutus* (Fig. 16) ***vexillarius*** Marshall (p. 232)

– Body without lateral stripe. Eyes smaller and more strongly convex, as in *A. ebrius* (Fig. 17) . . . . ***inornatus*** sp. n. (p. 233)

13 (11) Longest diameter of eyes (faceted area) *c.* × 0·8 shortest distance between them. Elytral processes very short and each with a prominent swelling at base on inner side ***asper*** Marshall (p. 216)

– Longest diameter of eyes < × 0·6 shortest distance between them. Elytral processes without any swelling at base 14

14 (13) Spread of elytral processes exceeding greatest width of elytra proper (males) 15

– Spread of elytral processes about equal to greatest width of elytra proper (females) . 18

15 (14) Elytral processes slender, subisodiametric, ± terete. Scales on elytra in great part bright rust-brown with a prominent whitish patch near base and another on declivity below processes (Fig. 5) . . . . ***stellifer*** sp. n. ♂ (p. 250)

– Elytral processes usually broader and ± flattened but if slender, then elytra without pale patch near base 16

16 (15) Elytral processes straight, stout and steeply rising (in profile view). Apical region of aedeagus elongate, tip usually thickened (Figs 218, 219, 222–225) 17

– Elytral processes more elongate and usually less steeply rising but, if very steep, then curved. Apical region of aedeagus broad and thin (Figs 226–232) ***olivaceus*** sp. n. ♂ (p. 251)

17 (16) Elytral processes very short, bluntly angulate, almost vertical (in profile view) and situated mid-way between base and apex of elytra (Fig. 238). Scales on elytra imbricate, concealing integument . . . . ***anatinus*** sp. n. ♂ (p. 253)

– Elytral processes longer, less strongly tapering, inclined posteriad and situated nearer to elytral apex than base. Scales on elytra usually very small, separate, not concealing integument, so that body appears dull black to unaided eye ***tenebricosus*** sp. n. ♂ (p. 253)

18 (14) Elytral processes inclined more strongly posteriad; EPI (Fig. 3) 107–123 19

– Elytral processes more steeply rising and more strongly diverging; EPI 105–107 ***tenebricosus*** sp. n. ♀ (p. 253)

19 (18) Prothorax with fringe of large erect setae along postero-ventral margin. Scales on elytra in great part bright rust-brown with a prominent whitish patch near base and another on declivity below processes . . . . ***stellifer*** sp. n. ♀ (p. 250)

– Prothorax without such setae. Elytra without pale patches, scales commonly dull greenish, paler on declivity . . . . ***olivaceus*** sp. n. ♀ (p. 251)

20 (10) Elytra globose, at least as strongly convex on disc as on top of declivity (in profile view) 21

– Elytra distinctly less strongly convex on disc than on top of declivity 23

21 (20) Antennal scape straight, flattened, ± parallel-sided and very feebly expanded at apex (Fig. 10). Length *c.* 12 mm . . . . ***ater*** sp. n. (p. 231)

– Antennal scape sinuous, ± terete, widening apicad throughout and strongly expanded at apex (Fig. 9). Length < 10·5 mm 22

22 (21) Setae on antennal scape curved and ± recumbent (on both edges). Elytral processes of ♂ subisodiametric and strongly tapering from base, becoming explanate in distal third and with a well defined white patch between their bases; processes of ♀ about half as long as those of ♂, not widening towards apex and seldom with a well defined white patch between their bases . . . . ***hydrographicus*** Marshall (p. 229)

– Setae on antennal scape stiffer, semi-erect (especially on leading edge). Elytral processes of ♂ not widening distally and without any well defined white patch between their bases (entire apical region pale); processes of ♀ acuminate, no longer than broad ***orientalis*** sp. n. (p. 231)

23 (20) Disc of pronotum with a large well defined flat or weakly concave area, the granulation of which is uniform throughout and similar to that on sides of pronotum. 24

– Disc of pronotum weakly convex or, if flattened, this area is undefined and granules larger on disc than on sides 25

24 (23) Elytral processes short and broad with a well defined outer edge which in ♂ continues along sides of elytra almost to base (Fig. 241) and in ♀ is produced as a low carina which runs obliquely across each elytron. Rostrum with a distinct median carina **acutus** sp. n. (p. 248)

– Elytral processes more elongate and rounded on their outer aspect (Fig. 233). Rostrum without a distinct median carina . . . . **strigifrons** sp. n. (p. 247)

25 (23) Elytral processes at least as long as broad, subisodiametric and steeply rising (Figs 234, 235).
Length >7 mm 26

– Elytral processes shorter than broad or, if longer, then dorso-ventrally compressed and not, or weakly rising 27

26 (25) Elytral processes longer than broad and distinctly diverging. Disc of pronotum weakly convex anteriorly, flattened posteriorly. Knees black. . . . **atrigenua** sp. n. ♂ (p. 227)

– Elytral processes as long as broad, parallel (♂) or weakly diverging (♀). Disc of pronotum strongly convex in anterior half, not flattened posteriorly. Femora unicolorous **nivosus** sp. n. (p. 226)

27 (25) Elytral processes broader than long, cone-shaped, without any swelling on meso-dorsal aspect 28

– Elytral processes more elongate or with a swelling on meso-dorsal aspect . . . 29

28 (27) Femora with knees black. Rims of pterygia microreticulate. Length *c.* 9 mm **atrigenua** sp. n. ♀ (p. 227)

– Femora unicolorous. Rims of pterygia smooth (Fig. 244). Length usually <9 mm ***ebrius wagneri*** subsp. n. ♀ (p. 245)

29 (27) Elytral interstria 3 (or $3+4+5$) $\pm$ distinctly raised for a short distance near base. Surface of elytra usually uneven and rough. Median lobe of aedeagus strongly curved or, if only moderately curved, then upper surface with a pair of sharp admedian carinae (Fig. 121).
Length $<7{\cdot}5$ mm 30

– Elytral interstria 3 not raised, or both 3 and 5 separately raised from near base of elytra to base of processes. Surface of elytra otherwise even, without any irregular elevations. Median lobe of aedeagus weakly curved; upper surface without sharp carinae . . 32

30 (29) Antennal scape claviform (Fig. 5); setae on leading edge, on average, shorter than greatest diameter of scape in middle of length. Internal sac of ♂ with pigmented spatulate denticles (Fig. 81) . . . . **asper** Marshall (p. 216)

– Antennal scape capitate; setae on leading edge, on average, longer than greatest diameter of scape in middle of length (Fig. 4). Internal sac of ♂ without, or with pointed unpigmented denticles 31

31 (30) Elytral processes very short in both sexes, $\pm$ rectangulate in ♂, rounded (sometimes almost obsolete) in ♀ (Figs 32, 36) . . . . **fallax** sp. n. (p. 214)

– Elytral processes longer and acute in ♂ (Fig. 38) (♀ unknown) . . **insperatus** sp. n. (p. 216)

32 (29) Prothorax of ♂ $\times 0{\cdot}68$ greatest width of elytra (excluding processes), its upper surface covered with raised round bead-like granules which occur over mid-line without interruption. Elytral processes of ♀ horizontal, directed posteriad or weakly diverging (their inner margins making an acute angle), often with an elongate swelling on inner side reaching almost to apex (Fig. 240). Average length 8·3 mm. Spermatheca with additional, blind lobe (Fig. 146).
Scales on body, in part, green . . . . **granulicollis** sp. n. (p. 225)

– Prothorax of ♂ $\times 0{\cdot}56$–$0{\cdot}66$ greatest width of elytra, its upper surface usually with fewer granules which are often divided along mid-line. Elytral processes of ♀ strongly diverging (their inner margins making an obtuse angle), without, or with a round swelling on inner side. Average length 6·6 mm. Spermatheca without additional lobe 33

33 (32) Scales on mesepisterna and arms of mesosternum (Fig. 1) similarly dense or imbricate ***ebrius wagneri*** subsp. n. ♂ (p. 245)

– Scales on mesepisterna smaller and less dense than those on arms of mesosternum or *vice versa* (never similarly dense or imbricate on both) 34

34 (33) Antennal scape with all fringing setae white. Scales on arms of mesosternum smaller and/or sparser than those on (adjacent) mesepisterna. Elytral processes fairly well developed in both sexes . . . . **canus** sp. n. (p. 224)

– Antennal scape with fringing setae brown, in part at least, but if all white then

scales on arms of mesosternum larger and/or denser than those on mesepisterna (Fig. 245). Elytral processes reduced in ♀ or in both sexes (Figs 40–47, 51, 54) 35

35 (34) Elytral processes elongate, truncate at apex, thickened along inner margin but without a distinct swelling (Figs 50, 52, 53).
Males 36

– Elytral processes short, angulate; if somewhat elongate, then inner margin distinctly swollen (Figs 46, 47) 39

36 (35) Elytral processes more slender (Fig. 50).
Flagellum about as long as pronotum . . . . ***avus marawakanus*** subsp. n. ♂ (p. 221)

– Elytral processes broader (Fig. 52) 37

37 (36) Prothorax about as long as broad, sides more strongly rounded (Fig. 49). Flagellum $> \times 1{\cdot}4$ as long as pronotum, more strongly curved towards base (Fig. 76) 38

– Prothorax, on average, $\times 1{\cdot}08$ as long as broad, sides less strongly rounded (Fig. 52). Flagellum about as long as pronotum ($< \times 1{\cdot}3$ as long) and evenly curved throughout its length . . . ***avus avus*** subsp. n. ♂ (p. 219); ***avus finisterrae*** subsp. n. ♂ (p. 221)

38 (37) Scales on arms of mesosternum dull. Flagellum $< \times 2$ as long as pronotum
avus karimuicus subsp. n. ♂ (p. 220)

– Scales on arms of mesosternum bright (Fig. 245). Flagellum $> \times 2$ as long as pronotum
sedlaceki sp. n. ♂ (p. 221)

39 (35) Elytral processes each with a gross, abscess-like swelling on its meso-dorsal aspect (Fig. 45). Pronotal granules, in general, few and small, often only $\times 1$–2 diameter of surrounding scales. Flagellum *c.* $\times 3$ as long as pronotum . . . ***suppuratus*** sp. n. (p. 223)

– Elytral processes without, or with a weaker swelling but, if almost as strong, then pronotal granules larger and more numerous. Flagellum $< \times 2$ as long as pronotum 40

40 (39) Elytral interstriae 3 and 5 ± distinctly convex. (Elytral processes usually with a distinct swelling on meso-dorsal aspect; those of ♂ (♂ has crater-like depression on ventrite 5) no wider than elytra, those of ♀ reduced, narrower than elytra, their posterior margins in a line or making a very obtuse angle with each other (Figs 40–43))
subcostatus sp. n. (p. 217)

– Elytral interstriae 3 and 5 not convex 41

41 (40) Spread of elytral processes exceeding greatest width of elytra proper 42

– Spread of elytral processes equal to, or less than greatest width of elytra proper.
Females 43

42 (41) Hind margin of last abdominal tergite thin, strongly rounded and with fringe of projecting setae . . . . ***avus finisterrae*** subsp. n. ♀ (p. 221)

– Hind margin of last abdominal tergite thickened, broadly truncate, without a fringe of setae . . . . ***avus intermedius*** subsp. n. ♂ (p. 220)

43 (41) Spread of elytral processes distinctly less than greatest width of elytra proper (Fig. 51). Elytra not, or very weakly, constricted at process bases; processes cone-shaped, with little trace of edges. Setae near sides of elytra usually about twice as long as those on femora . . . . ***avus marawakanus*** subsp. n. ♀ (p. 221)

– Spread of elytral processes equal to or only slightly less than greatest width of elytra proper. Elytra usually distinctly constricted at process bases; processes somewhat flattened, with a short but distinct outer edge towards apex. Setae near sides of elytra, on average, less than twice as long as those on femora 44

44 (43) Prothorax slightly broader than long, sides more strongly rounded (Fig. 49)
sedlaceki sp. n. ♀ (p. 221); ***avus karimuicus*** subsp. n. ♀ (p. 220)

– Prothorax as long as, or slightly longer than, broad; sides less strongly rounded (Fig. 54)
avus avus subsp. n. ♀ (p. 219); ***avus intermedius*** subsp. n. ♀ (p. 220)

45 (9) Disc of pronotum depressed and with traces of a narrow median carina (obscured by scales). Elytra shagreened.
Scales on body bright pale green . . . . ***bacchusi*** sp. n. (p. 228)

– Disc of pronotum not depressed and never with any trace of a median carina. Elytra shiny 46

46 (45) Rostrum with rims of pterygia milled. Setae near hind margin of prothorax, below sides, much smaller than those in mid-line (around post-coxal callus), usually recumbent and very inconspicuous 47

– Rostrum with rims of pterygia smooth (Fig. 244). Setae near hind margin of prothorax, below sides, usually as large as or larger than those in mid-line, fully erect and con-

spicuous (Fig. 243) but very small in a few cases.
Females 60

47 (46) Scales on mesepisterna smaller, duller and less dense than those on adjacent part of elytra. Length rarely >8 mm . . . . ***canus*** sp. n. (p. 224)

– Scales on mesepisterna similar to those on adjacent part of elytra or, if smaller, then length normally >8 mm 48

48 (47) Elytral processes elongate, tapering to a point, directed posteriad and curving mesad, caliper-like (Fig. 60). . . . . ***paradoxus*** sp. n. ♀ (p. 239)

– Elytral processes straight, diverging.
Males 49

49 (48) Ventrites 1 and 2 sparsely squamose in middle, the scales usually smaller than those on elytra and mostly well separated from each other. Scales on femora usually all smaller than those on elytra *or* of a markedly different colour.
Eyes moderately convex. Flagellum very short (Fig. 75) 50

– Ventrites 1 and 2 densely squamose throughout, the scales usually as large as those on elytra and $\pm$ contiguous. Scales on femora similar to those on elytra 52

50 (49) Setae in terminal fringes of elytral processes all very pale brown. Median lobe of aedeagus $> \times 3{\cdot}5$ as long as broad (Figs 174, 175).
Antennal funicle segments without any scales. . . . . ***paradoxus*** sp. n. ♂ (p. 239)

– Setae in terminal fringes of elytral processes pale anteriorly, dark posteriorly. Median lobe of aedeagus stouter, $< \times 3{\cdot}5$ as long as broad 51

51 (50) Antennal funicle segments rarely with any scales. Scales on prothorax and elytra usually distinctly green, those on femora mostly coppery. Elytral processes, on average, longer: EPI 132–148 . . . . ***cornutus virescens*** subsp. n. ♂ (p. 238)

– Antennal funicle segments 2 and 3 usually with a few very small ovate or elongate scales. Scales on prothorax and elytra pale grey or pearly, those on femora more metallic (sometimes coppery). Elytral processes, on average, shorter: EPI 122–134
cornutus cornutus Pascoe ♂ (Gulf District form) (p. 236)

52 (49) Inner margins of elytral processes $\pm$ straight, making a 'V' in antero-dorsal view.
Antennal funicle and fore tarsi normally devoid of scales 53

– Inner margins of elytral processes $\pm$ curved throughout their length, conjointly describing an uneven arc 56

53 (52) Scales on femora and vertex of head grey or pearly 54

– Scales on femora and vertex of head coppery or bronzy 55

54 (53) Average length about 9·5 mm. Scales on femora and vertex of head mostly dull bluish grey
hornabrooki sp. n. ♂ (p. 246)

– Average length about 7·5 mm. Scales on femora and vertex of head dull pale grey or pearly
ebrius ebrius Faust ♂ (upland forms) (p. 243)

55 (53) Elytral processes blade-like, outer half and apex abruptly flattened, forming a thin flange; interstria 1 raised at suture forming a low but sharp carina on declivity; strial granules inconspicuous. Eyes moderately convex . . . . ***ebrius angustus*** subsp. n. ♂ (p. 246)

– Elytral processes tapering, terete or with a distinct edge on outer side but not flattened; interstria 1 not, or bluntly, raised; strial granules usually conspicuous. Eyes strongly convex . . . . ***ebrius wagneri*** subsp. n. ♂ (p. 245)

56 (52) Granules on elytral striae and disc of pronotum absent or indistinct. Antennal club stouter (Fig. 21). Average length 6·7 mm. Largest scales on ventrite 5 more than half as wide as those in middle of ventrite 2. Flagellum as long as median lobe of aedeagus
mus sp. n. ♂ (p. 240)

– Granules on elytral striae and disc of pronotum small but distinct. Antennal club more slender (Fig. 20). Average length $>7{\cdot}0$ mm. Largest scales on ventrite 5 usually less than half as wide as those on ventrite 2. Flagellum either much longer or much shorter than median lobe of aedeagus 57

57 (56) Antennal funicle segments 2 and 3 with dense, very broad scales; setae on these segments stout, truncate at apex, contrasting strongly with fine, pointed setae on segment 7.
Segments 1 and 2 of fore tarsi with dense broad scales; fore coxae usually with a few scales among the setae on anterior or mesal aspects 58

– Antennal funicle segments 2 and 3 with recumbent silky hairs and sometimes a few lanceolate or very small ovate scales; setae on these segments slender, usually finely pointed, differing little or not at all from those on segment 7 59

58 (57) Eyes moderately convex (Fig. 16). Average length 8·5 mm. Elytra proper widest at process bases (Fig. 56). Flagellum much shorter than median lobe of aedeagus
cornutus cornutus Pascoe ♂ (p. 235)

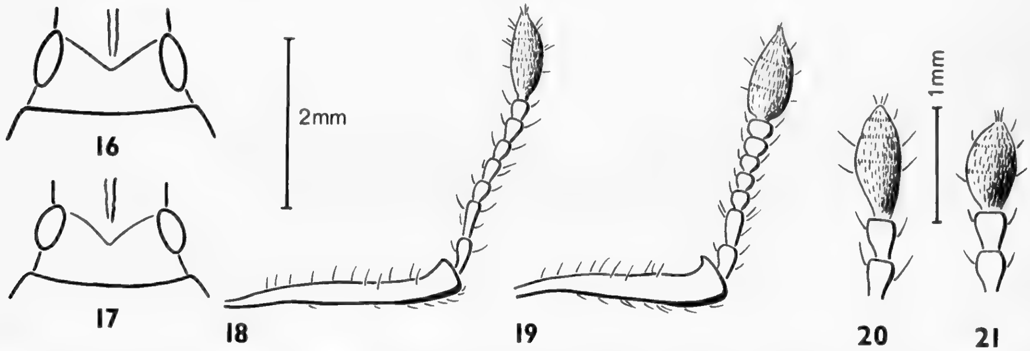
– Eyes strongly convex (Fig. 17). Average length 7·1 mm. Elytra proper widest in front of process bases (Fig. 64). Flagellum much longer than median lobe of aedeagus
ebrius ebrius Faust ♂ (lowland form) (p. 242)

59 (57) Shortest diameter of eye × 1·3–1·8 longest diameter of antennal scape in middle of length. Elytra proper widest in front of process bases (Figs 64, 73). Flagellum much longer than median lobe of aedeagus . . . ***ebrius ebrius*** Faust ♂ (intermediate forms) (p. 242)

– Shortest diameter of eye × 1·9–2·4 longest diameter of antennal scape in middle of length. Elytra proper widest at process bases (Fig. 56). Flagellum much shorter than median lobe of aedeagus . . . . ***cornutus tenuiscapus*** subsp. n. ♂ (p. 237)

60 (46) Spread of elytral processes fully as wide as elytra proper at their widest point (Fig. 63). Scales on ventrites 1 and 2 sparse and smaller than those on elytra.
Antennal funicle segments with silky hairs but no scales. Scales on prothorax and elytra usually distinctly green . . . . . . ***cornutus virescens*** subsp. n. ♀ (p. 238)

– Spread of elytral processes narrower than elytra proper at their widest point. Scales on ventrites 1 and 2 dense and almost or quite as large as those on elytra 61



18 19 20 21

Figs 16–21 *Apirocalus* (*A.*) species. Heads of (16) *cornutus*, (17) *ebrius*. Antennae of (18) *acutus* ♂, (19) *acutus* ♀. Antennal club of (20) *ebrius*, (21) *mus*.

61 (60) Elytra with short but distinct, usually flattened processes (EPI 121–148) 62

– Elytral processes represented by stout angulations (EPI 106–124) 64

62 (61) Elytral processes cariniform, in line with, or parallel to, elytral outline (Fig. 58). Antennal funicle with dense scales on segments (1–)2–4(–6)
cornutus cornutus Pascoe ♀ (Brown River form) (p. 236)

– Elytral processes narrower, fin-like, diverging. Antennal funicle without, or with a few small scales on segments (1,) 2 and 3 only 63

63 (62) Setae towards sides of elytra about twice as long as those on femora, erect. Postero-ventral margin of prothorax with large erect setae, similar to those near sides of elytra and much longer than those at sides of prothorax. Length <7 mm. Ventrites 3–5 fairly densely squamose . . . . ***mus*** sp. n. ♀ (p. 240)

– Setae towards sides of elytra about as long as those on femora, ± recumbent. Postero-ventral margin of prothorax with a few small setae, at most as long as those at sides of prothorax. Length >7 mm. Ventrites 3–5 with a few scattered scales only
ebrius angustus subsp. n. ♀ (p. 246)

64 (61) Antennal funicle segments 2 and 3 with dense, very broad scales; setae on these segments stout, pale, truncate at apex, contrasting strongly with fine dark setae on segment 7. 65

– Antennal funicle segments 2 and 3 with recumbent silky hairs and sometimes, in addition, a few lanceolate or very small ovate scales; setae on these segments slender, brownish, usually finely pointed, differing little or not at all from those on segment 7 . . . 66

65 (64) Average length 9 mm. Eyes usually only moderately convex (Fig. 16). Sides of elytra less strongly rounded; spread of processes only slightly less than greatest width of elytra proper (Fig. 57). Spermathecal duct about as long as spermatheca
cornutus cornutus Pascoe ♀ (p. 235)

– Average length 7·8 mm. Eyes more strongly convex (Fig. 17). Sides of elytra more strongly rounded; spread of processes distinctly less than greatest width of elytra proper (Fig. 65). Spermathecal duct several times length of spermatheca
ebrius ebrius Faust ♀ (lowland form) (p. 242)

66 (64) Scales on femora mostly dull bluish grey . . . . . . ***hornabrooki*** sp. n. ♀ (p. 246)

– Scales on femora pale grey, pearly or pale bronzy brown 67

67 (66) Setae on leading edge of scape almost as long as its longest median diameter; shortest diameter of eye × 2·0–2·5 same measurement.
Eyes only moderately convex. Spermathecal duct about as long as spermatheca
cornutus tenuiscapus subsp. n. ♀ (p. 237)

– Setae on leading edge of scape distinctly shorter than its longest median diameter; shortest diameter of eye × 1·5–2·1 same measurement 68

68 (67) Eyes more strongly convex (Fig. 17). Setae on leading edge of scape ± erect (Fig. 14). Fore coxae without any scales. Spermathecal duct several times longer than spermatheca, convoluted 69

– Eyes less strongly convex (Fig. 16). Setae on leading edge of scape recumbent (Fig. 12). Fore coxae with a few scales among the setae. Spermathecal duct about as long as spermatheca, straight . . . . ***cornutus cornutus*** Pascoe ♀ (Gulf District form) (p. 236)

69 (68) Granules in striae 1–3 at least as large as surrounding scales. Setae on postero-ventral margin of prothorax often very small and inconspicuous (as in ♂)
ebrius wagneri subsp. n. ♀ (p. 245)

– Granules in striae 1–3 smaller than surrounding scales. Setae on postero-ventral margin of prothorax always large and conspicuous (often visible from above)
ebrius ebrius Faust ♀ (upland forms) (p. 243)

Check-list

APIROCALUS Pascoe

Subgenus *MOLOBRIUM* subgen. n. (p. 207)
- ***gracilis***-group (p. 207)
  - ***gracilis*** **sp. n.**
  - ***stibicki*** **sp. n.**
- ***io***-group (p. 209)
  - ***io*** **sp. n.**
  - ***celatus*** **sp. n.**
  - ***occultator*** **sp. n.**
  - ***terrestris*** **sp. n.**
  - ***t. terrestris*** **subsp. n.**
  - ***t. dissidens*** **subsp. n.**

Subgenus *APIROCALUS* Pascoe (p. 214)
- ***fallax***-group (p. 214)
  - ***fallax*** **sp. n.**
  - ***insperatus*** **sp. n.**
  - ***asper*** Marshall
- ***avus***-group (p. 217)
  - ***subcostatus*** **sp. n.**
  - ***avus*** **sp. n.**
  - ***a. avus*** **subsp. n.**
  - ***a. intermedius*** **subsp. n.**
  - ***a. karimuicus*** **subsp. n.**
  - ***a. finisterrae*** **subsp. n.**
  - ***a. marawakanus*** **subsp. n.**
  - ***sedlaceki*** **sp. n.**
  - ***suppuratus*** **sp. n.**
  - ***canus*** **sp. n.**
- ***granulicollis***-group (p. 225)
  - ***granulicollis*** **sp. n.**
- ***nivosus***-group (p. 226)
  - ***nivosus*** **sp. n.**
  - ***atrigenua*** **sp. n.**
  - ***bacchusi*** **sp. n.**
- ***hydrographicus***-group (p. 229)
  - ***hydrographicus*** Marshall
  - ***orientalis*** **sp. n.**
  - ***ater*** **sp. n.**
  - ***vexillarius*** Marshall
  - ***inornatus*** **sp. n.**
- ***cornutus***-group (p. 233)
  - ***cornutus*** Pascoe
  - ***c. cornutus*** Pascoe
  - ***c. tenuiscapus*** **subsp. n.**
  - ***c. virescens*** **subsp. n.**
  - ***paradoxus*** **sp. n.**
  - ***mus*** **sp. n.**
  - ***ebrius*** Faust **stat. n.**
  - ***e. ebrius*** Faust
  - ***e. wagneri*** **subsp. n.**
  - ***e. angustus*** **subsp. n.**
  - ***hornabrooki*** **sp. n.**
- ***strigifrons***-group (p. 247)
  - ***strigifrons*** **sp. n.**
- ***acutus***-group (p. 248)
  - ***acutus*** **sp. n.**
- ***olivaceus***-group (p. 249)
  - ***stellifer*** **sp. n.**
  - ***olivaceus*** **sp. n.**
  - ***tenebricosus*** **sp. n.**
  - ***anatinus*** **sp. n.**

A. thomsoni Waterhouse, 1889 (St Aignan [Misima] I.) has been previously transferred to *Peteinus* Marshall by Marshall (1956 : 114). *A. gestroi* Pascoe, 1885 (Yule I.) is here transferred to a new genus (p. 253).

Descriptions of species

All descriptions of species are similarly constructed so as to facilitate comparison of a given structure in a range of species. In descriptions of higher categories, the characters are given roughly in order of importance but in both cases the genitalia are dealt with after the externals. Each species-description begins with a statement of range and altitude which will help to check the accuracy of the determination. Bionomic data are given in a separate section with, in each instance, the locality and collector's initials so that the full data of the specimens concerned can be found in the list of material examined.

All measures of length are given in metric units. Non-metric data are quoted as given, with the metric equivalent in square brackets. Place-names are also quoted as given. If an alternative spelling occurs on maps or in the Village Directory (Anonymous, 1968, Department of District Administration) this is added in square brackets but is not necessarily 'more correct'. Bionomic data are quoted strictly *verbatim*; I have not attempted to add or substitute scientific names of plants where only common names are given (or *vice versa*) or to check the current status of scientific names. Although paratypes of new species are sometimes mentioned in the section on doubtful records, other specimens there referred to are excluded from the type-series.

Subgenus *MOLOBRIUM* subgen. n.

Type-species: *Apirocalus io* sp. n.

Small species (4·5–7·5 mm). Elytral processes tuberculiform, erect or suberect in front view and inclined posteriad in side view. One or two much smaller accessory tubercles or granules sometimes present on outer side of main tubercle. Antennal scape claviform, not or indistinctly capitate. Sexes similar; prothorax about as long as broad but disc of pronotum more distinctly granulate in ♀. Abdominal ventrite 1 simple in ♀, concave or sulcate (sometimes very narrowly) in ♂; ventrite 5 usually simple in both sexes. Scales brown or greenish, generally dense but seldom imbricate, absent from antennal funicle and tarsi. Setae generally stiff, erect or suberect, parallel-sided and with truncate apices. Median lobe of aedeagus varying greatly between the species; upper surface often with a pair of smooth admedian carinae; flagellum short (rarely absent). Spermatheca compact and with distinct gland-lobe; styli of ovipositor ×3–4 as long as broad.

This subgenus occurs in the Central Highlands between 750 and 2500 m. Its range extends from the Star Mts in the east to the Huon Peninsula in the west and to Wau in the south (Maps 1, 2).

The name of this new subgenus is derived from a Greek word meaning 'young of wild swine'.

The earliest record known to me is of *A.* (*M.*) *terrestris* taken at Nondugl on 1st December 1950 by W. W. Brandt. The six species and one subspecies here recognized are all new and fall into two species-groups.

The *gracilis*-group

Elytral processes weakly diverging (Fig. 2). Arms of mesosternum and (adjacent) mesepisterna almost smooth and devoid of scales. Scales on antennal scape much smaller than those on pronotum. Setae on scape not, or only slightly, stouter than those on funicle. Median lobe of aedeagus ×3·3–3·5 as long as broad and ×0·9 as long as pronotum; struts ×1·3–1·4 as long as median lobe and ×1·2–1·3 as long as pronotum; flagellum ×0·2–0·3 as long as pronotum.

Apirocalus (Molobrium) gracilis sp. n.

(Figs 2, 86, 87, 88; Map 2)

Range. Northern Morobe District (Finisterre Range). Altitude: 1200–1500 m.

Length 6·2–6·9 mm. Black; legs and antennae very dark red or black. Scales on body uniform pale green or grey-green but sometimes brown with reddish reflexions between and in front of elytral processes; scales on head and legs pale green, grey or lilac, often with fiery golden red reflexions. *Head* with frons weakly declivous, making a weak angle with rostrum, its surface marked with irregular rugae which radiate from the deep but narrow rostro-frontal furrow and continue round back of eyes; area above eyes with a few pale suberect setae and fairly dense scales which thin out towards vertex with only a few behind eyes and a narrow patch of small scales and recumbent whitish setae against lower edge of eyes; eyes moderately convex. *Rostrum* widens evenly from base to near apex, pterygia only slightly wider than genae; dorsal surface ± flat, sides narrowed behind antennal insertions, with traces of a median carina in basal part and, above antennal insertions, a pair of mis-shapen shiny granules (sometimes indistinct); apex strongly rounded in profile view, epistome almost vertical, convex and polished, with a few small setiferous punctures, contrasting with adjacent strongly rugose area of apex; dense scales and pale setae present except on underside, in scrobes and on dorsal surface beyond level of antennal insertions. *Antennae* with funicle segment 2 slightly to distinctly longer than 1; remaining segments subequal, about half as long as 2 and all distinctly longer than broad; club ×2·6–2·8 longer than broad, widening fairly evenly from base to near middle; scape slender, very weakly sinuous, thickening only slightly in basal two-thirds, thence more strongly, apex rounded and with weak pre-apical constriction on anterior side; upper surface, in part, with very fine longitudinal rugulae and lipped punctures, between and around which lie small ovate scales (about half as large as those on pronotum), leaving the raised surfaces exposed; setae fine, brown and suberect on fore edge (longest exceeding greatest diameter of scape in middle of length), shorter and less erect elsewhere, only slightly coarser than those on funicle. *Prothorax* widest a little in front of middle; sides moderately and fairly evenly rounded; surface uneven, incompletely covered by scales, sometimes with some irregular shiny granules; setae much smaller than those on scape, brown or white, often strongly curved and ± recumbent, rather inconspicuous. *Elytra* ovate, disc weakly convex; main tubercle on interstriae 3–5 (♂) or 3–4 (♀), in latter case a small accessory granule present in interstria 5; main tubercles oval in section and surmounted by a prominent tuft of large white setae (×2–3 as long as those on femora); TSI 66–70; strial punctures distinct and in regular rows on disc; interstriae subequal in width; scales uniform, dense but mainly separate, not covering surface completely (similar to those on pronotum); setae on sides and disc pale brown or white, very small and inconspicuous; those near sides (on interstriae 6 and 7) and on declivity larger (similar to those on scape), mainly brown but white around apex. *Mesepisterna* coarsely microreticulate and with a few (2–6) very small ill-defined punctures containing very small appressed pale setae (about as long as diameter of puncture) but no scales; arms of mesosternum with 1–4 similar setiferous punctures but surface usually highly polished, at least in middle. *Metasternum* flat in middle; scales near sides similar to those on elytra, becoming less dense in middle; ventrites 1 and 2 with some similar scales towards sides, ventrite 5 with a few smaller scales; setae throughout sterna and venter fine, erect or suberect, pale and iridescent (whitish near sides), those on metasternum and ventrites 1 and 2 varying in size but on average as long as (but finer than) those on femora; those on ventrites 3–5 about half as long, irregularly distributed on ventrite 5 but arranged in a single fairly regular transverse row on 3 and 4. *Legs* with femora moderately swollen; fore and hind straight, middle femora slightly reflexed dorsad; fore tibiae weakly, middle tibiae very weakly, incurved towards apex; hind tibiae straight; inner (ventral) edge of fore tibiae sinuate and with distinct teeth; inner edges of middle and hind tibiae straight and with smaller teeth; scales on femora smaller than those on elytra, irregularly distributed, mostly separate; those on tibiae smaller than those on femora; setae whitish throughout except towards apices of tibiae (brown). *Sexual dimorphism* slight; ventrite 1 concave in ♂, ± flat in ♀; single ♀ examined has smaller main elytral tubercles with an accessory granule in interstria 5 and surface of disc of pronotum is more uneven and with larger, more distinct granules than in ♂.

Genitalia. Median lobe of aedeagus (Figs 86, 87) as long as pronotum, ×3·5 as long as broad, tapering and arched in apical third, apex bluntly rounded; upper surface with traces of a pair of longitudinal carinae in basal third; struts ×1·3 as long as median lobe, manubrium < ×0·6 as long as median lobe, flagellum ×0·2 as long. Spermatheca (Fig. 88) normal; spermathecal gland claviform, arising from a broad but distinct prominence; spermathecal duct about equal to overall length of spermatheca; spout unpigmented.

Holotype ♂, Papua New Guinea: Finisterre Range, Saidor, Matoko [1500 m], 29.viii–5.ix.1958 (*W. W. Brandt*), in BPBM.

Paratypes. Papua New Guinea: 1 ♂, same data as holotype (BMNH); 1 ♀, ditto except 6–24.ix.1958; 1 ♂, Saidor, Funyende, 1200 m, 24.ix.1958 (*W. W. Brandt*) (both in BPBM).

Specimens examined: 4; dissected: 3 (2 ♂, 1 ♀).

Apirocalus (Molobrium) stibicki sp. n.

(Figs 31, 89–91; Map 2)

Range. Northern Morobe District. Altitude: 1800 m.

♂. Length 6·9 mm. Black in all its parts. Scales pale grey-brown with coppery reflexion. *Head* and *rostrum* as in *A. gracilis* except frons more steeply declivous. *Antennae* as in *A. gracilis* except setae on scape even less coarse, closely resembling those on funicle. *Prothorax* widest a little in front of middle, there strongly rounded, tapering thence to extremities; surface of disc uneven, with a few small, irregular shiny granules; scales dense but not covering surface completely; setae much smaller than those on scape, brown and inconspicuous. *Elytra* (Fig. 31) oblong-ovate, disc flat; main tubercles in interstriae 3–4 (also encroaching on 2), oval in section and more strongly inclined posteriad than in *A. gracilis*; much smaller accessory tubercle in interstria 5 and granule in 6, all three in a straight line which, if produced round side of elytra would reach metasternum; TSI 57; strial punctures distinct and in regular rows on disc; interstriae 3 and 5 wider than 2 and 4; some slight development of sinuous transverse folds across disc; a scale-sized, bead-like setiferous granule is associated with each strial puncture and similar granules, similarly spaced, occur along each interstria; scales dense and uniform but great majority are separate, not covering surface completely; setae as in *A. gracilis* but all brown except some around apex and on anterior side of tubercles; setae on tubercles at most only twice as long as those on femora. *Mesepisterna* as in *A. gracilis*; arms of mesosternum coarsely microreticulate and without punctures or setae. *Metasternum* with depressions behind middle coxae which leave a raised median area; ventrite 1 with a very narrow median sulcus (×0·15 width of intercoxal process), delimited by very slender smooth rugiform carinae; scales and setae as in *A. gracilis*. *Legs* as in *A. gracilis* but tibial teeth indistinct, fore tibiae strongly incurved in distal third and setae mostly pale brown or hyaline.

Aedeagus (Figs 89–91) ×0·86 as long as pronotum, ×3·3 as long as broad, strongly arched, apical region tapering to a blunt point, upper surface without any carinae; struts ×1·4 as long as median lobe, manubrium shorter than median lobe, flagellum ×0·3 as long.

Holotype ♂, Papua New Guinea: Morobe District, Lae, Melambi R[iver], Zitare Vill[age], 6000 [ft] [1800 m], 25.xii.1956 (*J. H. Ardley*), in BMNH.

Named after Dr J. N. L. Stibick, Senior Entomologist, DAPM, who sent me the specimen.

The *io*-group

Elytral processes erect. Arms of mesosternum and (adjacent) mesepisterna with scales; mesepisterna strongly punctured. Scales on antennal scape almost as large as those on pronotum. Setae on leading edge of scape usually distinctly stouter than those on funicle. Median lobe of aedeagus ×1·8–2·7 as long as broad and ×0·5–0·8 as long as pronotum; aedeagal struts ×1·7–3·2 as long as median lobe and ×1·3–1·7 as long as pronotum; flagellum ×0·3–0·6 as long as pronotum (rarely absent).

Distinguished from the *gracilis*-group by the shorter median lobe of the aedeagus and the longer struts and by the squamose and more strongly punctured mesepisterna. The legs and antennae are stouter than in the *gracilis*-group; the scales are larger and denser (especially on the pronotum) and the setae on the body are generally longer and stouter.

Apirocalus (Molobrium) io sp. n.

(Figs 30, 85, 92, 93, 103, 104; Map 2)

Range. Morobe District. Altitude: 750–1400 m.

Length 5·3–6·2 mm ($\bar{x}$ (10) = 5·7). Black; parts of legs and antennae very dark red. Scales mainly bronzy or coppery when clean, sometimes variegated with paler scales. *Head* with frons declivous, making a distinct angle with rostrum, its surface (beneath the scales) with fine rugulae, radiating from the very deep well defined rostro-frontal furrow; vestiture as in *A. gracilis*; eyes strongly convex. *Rostrum* parallel-sided in middle or widening continuously from base; pterygia prominent, distinctly wider than genae; median rostral carina variable, usually well defined and very broad (often as broad as funicle) but very low and tapering to a point posteriorly (otherwise as in *A. gracilis* but with no granules above antennal insertions). *Antennae* with funicle segment 2 slightly longer than 1, 3–7 subequal, about half as long as 2,

shortest (5 or 6) slightly longer than broad; club ×2·3 as long as broad; scape thickens evenly from near base to very near apex with scarcely any trace of apical expansion; densely squamose (except around funicle insertion) and with stout, weakly curved brown or brown+white setae, suberect on fore edge, shorter and less strongly raised elsewhere, the longest longer than greatest diameter of scape in middle of length; funicle segments with fine brown setae and very fine recumbent hairs, sparse on basal segments but becoming denser apically. *Prothorax* widest at or a little in front of middle, there strongly rounded, tapering thence to extremities; surface covered with deep irregular pits (concealed by scales), disc sometimes with bead-like granules, the largest of which are arranged in two admedian rows; setae similar to those on antennal scape, smaller and brown on disc, larger and brown or white towards sides, all pointing towards mid-line. *Elytra* ovate or rotund (some ♀); disc ± flattened; tubercles regularly cone-shaped, situated in interstriae 2–4, adjacent sections of interstriae 5 and 6 weakly convex; TSI 35–41 ($\bar{x}$ (13)=38); strial punctures fairly regular, sometimes disturbed on disc by weak development of sinuous transverse folds; very small setiferous granules (smaller than a scale) in single rows on interstriae in ♂, similar or < twice as large in ♀; setae on disc similar to those on scape, semi-erect and brown, elsewhere larger (about twice as long as those on femora), often fully erect, almost straight, mostly brown (Fig. 30); tubercles with dark brown setae which do not form apical tufts. *Mesepisterna* with dense scales, as large as those on elytra and often slightly larger than those on arms of mesosternum. *Metasternum* and ventrites 1–2 densely squamose and with numerous white setae resembling those on pronotum; ventrites 3–5 with sparser, much smaller scales and smaller, mainly brownish setae. *Legs* with all femora inflated and weakly reflexed dorsad; fore and middle tibiae weakly and fairly evenly incurved, hind tibiae almost straight; hind tarsal claw-segment ×1·9–2·0 as long as segment 3; scales dense on exposed parts of femora and on outer (dorsal) aspect of tibiae; femora with a patch of pale scales on underside of swollen part; setae similar to those on prothorax, mainly whitish, especially on widest part of femoral swelling. *Sexual dimorphism* slight; ventrite 1 of ♂ has a shallow longitudinal sulcus, sides of which are raised but do not form distinct carinae; width of this sulcus is less than half that of intercoxal process of ventrite 1; ventrite 5 simple. Ventrite 1 of ♀ simple; ventrite 5 with an irregular elevation on disc, often excavated on its posterior aspect. Elytra of ♀ usually broader and more strongly rounded than those of ♂.

Genitalia. Median lobe of aedeagus (Figs 92, 93) ×0·7–0·8 as long as pronotum, ×2·5–2·7 as long as broad; upper surface with a pair of large black longitudinal carinae which project apicad over phallotreme; struts ×1·7 as long as median lobe, flagellum ×0·3 as long (single observations). Spermatheca (Figs 103, 104) normal; spermathecal gland pedunculate, arising from a large prominence; spermathecal duct only slightly exceeding overall length of spermatheca; spout straight, unpigmented.

Holotype ♂, PAPUA NEW GUINEA: Morobe District, Wau, 1200 m, 2–10.xi.1961 (*J. & M. Sedlacek*), in BPBM.

Paratypes. PAPUA NEW GUINEA: 2 ♀, same data as holotype (BPBM, BMNH); 2 ♂, 1 ♀, ditto except 12.vii.1961 (2 BPBM, 1 BMNH); 1 ♂, ditto except 17.vii.1961; 1 ♀, ditto except 15.viii.1961 (*J. Sedlacek*) (both BPBM); 1 ♀, Wau, 3450 ft [1035m], 10.xi.1954 [*Szent–Ivany*] (DAPM); 1 ♂, Wau, 1400 m, 27.viii.1961 (*J. Sedlacek*) (BMNH); 1 ♀, ditto except 1200 m, 1–3.x.1963; 1 ♀, Bulolo, 750 m, 5.x.1965 (*J. Sedlacek*) (both BPBM); 4 ♀, Herzog Mts, Vagau, Station No. 137, *c.* 4000 ft [1200 m], 4–17.i.1965 (*M. E. Bacchus*) (BMNH).

Specimens examined: 16; dissected: 7 (2 ♂, 5 ♀).

Bionomic data. 'On pumpkin flowers' (Wau, S–I).

The name given to this species commemorates my great pleasure at finding such a distinctive aedeagus in this otherwise undistinguished weevil. I have made it the type-species of the subgenus *Molobrium* in preference to *A. terrestris* (a more obviously suitable choice) partly on account of its distinctive aedeagus and partly because, although its range appears to be restricted, it contains the Wau Ecology Institute, which should mean that this species is more readily accessible for study than the others.

Apirocalus (Molobrium) celatus sp. n.

(Figs 94–96, 100, 101; Map 2)

Range. Eastern Highlands. Altitude: 1350 m.

Length 6·0–6·8 mm ($\bar{x}$ (9)=6·4). Black; parts of legs and antennae very dark red. Scales bronzy, pearly or greenish when clean. *Head* with frons rather steeply declivous, making a distinct angle with rostrum, its surface with irregular rugae radiating from the deep rostro-frontal furrow; vestiture as in

A. gracilis; eyes strongly convex. *Rostrum* ± strongly constricted between base and pterygia; median carina variable; otherwise as in *A. io*. *Antennae* with funicle segments as in *A. io*; club ×2·1–2·5 as long as broad; scape thickens rather abruptly in distal third, fore edge with very weak pre-apical constriction; vestiture as in *A. io*. *Prothorax* as in *A. io* except bead-like granules on disc seldom arranged in rows and setae towards sides mostly white and pointing towards centre of disc. *Elytra* ovate, flattened on disc; main tubercle situated in interstriae 3–4, its base encroaching on 2; on its outer side is a small accessory tubercle, partly fused with the large one yet distinct from it and clearly standing in interstria 5; TSI 48–57 ($\bar{x}$ (6) = 53); otherwise as in *A. io* except setae never fully erect and those on interstriae 6 and 7 often white; main tubercles surmounted with an untidy tuft of very large setae, whitish on anterior side of tubercle and dark brown on posterior side; accessory tubercles with a tuft of 2–4 brown setae. *Mesepisterna* with a few small scales only; those on arms of mesosternum larger and denser. *Metasternum* and venter as in *A. io*. *Legs* with fore femora inflated, mainly on antero-dorsal aspect, hence markedly asymmetrical; middle and hind femora progressively less inflated and less asymmetrical; fore and middle tibiae weakly incurved towards apex, hind tibiae ± straight; hind tarsal claw-segment ×1·9–2·5 as long as segment 3; scales and setae as in *A. io* except femora without pale patch. *Sexual dimorphism* slight; ventrite 1 of ♂ has a broad, very deep median sulcus, delimited by a pair of prominent longitudinal carinae; although sulcus may extend shallowly on to ventrite 2, the carinae terminate rather abruptly at the interventrital suture; ventrite 1 of ♀ without any sulcus or carinae.

Genitalia. Median lobe of aedeagus (Figs 94–96) about half as long as pronotum and twice as long as broad; upper surface with a pair of large admedian carinae in basal half; apical half very strongly concave; struts ×2·5 as long as median lobe, manubrium distinctly longer than median lobe, flagellum *c*. ×0·7 as long. Spermatheca (Figs 100, 101) etc., as in *A. io* but spout sometimes pigmented.

Holotype ♂, PAPUA NEW GUINEA: Eastern Highlands, Kassam, 48 km E. of Kainantu, 1350 m, 28.x.1959 (*T. C. Maa*), in BPBM.

Paratypes. PAPUA NEW GUINEA: 1 ♂, same data as holotype (BMNH); 4 ♀, ditto except 7.xi.1959 (3 BPBM, 1 BMNH); 1 ♂, 2 ♀, Kassem Pass, 24.ii.1974 (*R. Hornabrook*) (2 RWH, 1 BMNH).

Specimens examined: 9; dissected: 5 (2 ♂, 3 ♀).

Kassam is believed to be much nearer Kainantu than stated above.

The name ('hidden') refers to the close superficial resemblance between this species and the following.

Apirocalus (Molobrium) occultator sp. n.

(Figs 79, 80, 84, 97–99, 102; Map 2)

Range. Madang District (Finisterre Range). Altitude: 1065–1665 m.

Length 5·8–6·8 mm ($\bar{x}$ (10) = 6·2). Black; parts of legs and antennae very dark red. Scales mainly bronzy or greenish when clean. *Head* with frons weakly declivous, making a very weak angle with rostrum, its surface weakly, often confusedly rugose; vestiture as in *A. gracilis*; eyes strongly convex. *Rostrum* ± strongly constricted between base and pterygia; median carina variable; otherwise as in *A. io*. *Antennae* as in *A. io*; club ×2·4–2·7 as long as broad. *Prothorax* as in *A. io*. *Elytra* ovate, flattened on disc; base of main tubercle ill-defined but covering interstriae 2–5; usually with a small accessory granule on outer aspect, often high up on side of main tubercle (sometimes indistinct); TSI 47–55 ($\bar{x}$ (8) = 52); strial punctures distinct and regular; surface of disc even, with little or no trace of sinuous transverse folds; vestiture as in *A. celatus*. *Mesepisterna*, etc. as in *A. celatus*. *Metasternum* and venter as in *A. io*. *Legs* as in *A. celatus* but fore femora less strongly inflated and less asymmetrical. *Sexual dimorphism* very slight; ventrite 1 of ♂ with broad ill-defined sulcus, not present in ♀.

Genitalia. Median lobe of aedeagus (Figs 97–99) ×0·5–0·7 as long as pronotum and ×1·8–2·1 as long as broad; upper surface with a pair of admedian carinae in basal fourth; struts ×2·5–2·8 as long as median lobe, manubrium about as long as median lobe, flagellum absent; anterior end of internal sac with a pair of bilobed invaginations (Figs 79, 80); opening of ejaculatory duct not located with certainty. Spermatheca (Fig. 102) normal; spermathecal gland arising from an indistinct prominence; spermathecal duct shorter than overall length of spermatheca; spout curved, tapering and pigmented, with very thick wall and narrow lumen (Fig. 84).

Holotype ♂, PAPUA NEW GUINEA: Madang District, Finisterre Range [Naho river valley], Damanti, 3550 ft [1065 m], Station No. 30, 2–11.x.1964 (*M. E. Bacchus*), in BMNH.

Paratypes. PAPUA NEW GUINEA: 1 ♀, same data as holotype; 1 ♂, ditto except Station No. 46; 1 ♂, Finisterre Range, Budemu [Butemu], Station No. 51, *c.* 4000 ft [1200 m], 15–24.x.1964 (*M. E. Bacchus*); 1 ♂, 1 ♀, Finisterre Range, Moro, Station No. 78, *c.* 5550 ft [1665 m], 30.x–15.xi.1964 (*M. E. Bacchus*) (all BMNH); 3 ♂, 1 ♀, ditto except Station No. 85 (3 BMNH, 1 BPBM).

Specimens examined: 10; dissected: 5 (3 ♂, 2 ♀).

Bionomic data. 'Ex rotting vegetation' (Moro, Station No. 85).

This species is very remarkable for its lack of a flagellum and for the curious invaginations at the anterior end of the internal sac in the male. The strongly sclerotized beak-like spout in the bursa copulatrix of the female also has no parallel among the other species. Externally, however, it closely resembles the other members of the species-group; this circumstance suggested its name ('concealer').

Apirocalus (Molobrium) terrestris sp. n.

(Figs 78, 105, 107–110; Map 2)

Range. Eastern, Western and Southern Highlands; Star Mts. Altitude: 1200–2500 m.

Length 4·6–6·3 mm. Black; parts of legs and antennae very dark red. *Head* with frons declivous, making a distinct angle with rostrum, its surface weakly rugose; scales imbricate above eyes, thinning out towards vertex and behind eyes, otherwise as in *A. gracilis*; eyes very strongly convex. *Rostrum* parallel-sided or weakly constricted between base and pterygia, which are usually weak; dorsal surface flat or evenly arched, sides slightly narrowed behind antennal insertions, apex strongly rounded (in profile view), epistome scarcely distinguishable; median rostral carina very variable (sometimes indistinct); vestiture as in *A. gracilis*. *Antennae* with funicle segment 2 = or < ×1·4 as long as 1, 3–7 subequal, about half as long as 2, shortest (usually 5) usually slightly broader than long; club ×2·0–2·6 as long as broad; scape as in *A. io* except setae on fore edge less erect and longest *not* exceeding greatest diameter of scape in middle of length; recumbent hairs on funicle denser on segments 6 and 7. *Prothorax* widest at, or a little in front of, middle; sides moderately rounded in middle, often with a very weak pre-apical constriction; surface very coarsely pitted, often uneven, often with traces of a narrow median sulcus; granules, when present, often divided along mid-line into two irregular admedian rows; scales dense; setae resemble those on scape and all point towards centre of disc. *Elytra* ovate; sides of disc flat or weakly concave; suture (interstria 1) raised on declivity and sometimes throughout its length; interstria 5 and sometimes also 3, more prominent than the others; main tubercle situated in interstriae 2–4; adjacent parts of interstriae 5 and 6 usually convex or even costate but without any tubercles or granules; TSI 40–51; strial punctures deep and fairly regular; interstriae with or without small bead-like setiferous granules (no larger than surrounding scales); scales very similar to those on pronotum, strongly appressed, dense, sometimes tessellate but not imbricate; setae similar to those on antennal scape, those near sides of elytra always less than twice as long as those on femora, those on declivity slightly larger, those on disc much smaller and inconspicuous (those on sides and all those in striae smaller still); tubercles surmounted with a loose, untidy tuft of large, often mainly whitish, setae. *Mesepisterna* (posteriorly) and arms of mesosternum with scales of similar size and density. *Metasternum* and venter as in *A. io* but setae finer. *Legs* with femora all about equally swollen; tibiae as in *A. celatus*; hind tarsal claw-segment ×1·8–2·0 as long as segment 3; vestiture as in *A. io* except middle and hind femora with a ± distinct ring of pale scales at widest point. *Sexual dimorphism* very slight; ventrite 1 of ♂ with an ill-defined, usually shallow sulcus, occupying less than half width of intercoxal process, flanked by either coarse irregular rugae or flattened matt areas; pronotum and elytra usually without any bead-like granules projecting through the scales. Ventrite 1 of ♀ sometimes weakly concave but with small bead-like granules on elytra and disc of pronotum.

Genitalia. Median lobe of aedeagus half as long as pronotum, oblong, very weakly curved and with no trace of carinae on upper surface; struts ×2·8–3·2 as long as median lobe. Spermatheca (Figs 105, 106) normal; spermathecal gland linear or claviform, arising from a distinct prominence; spermathecal duct *c.* ×3 overall length of spermatheca; spout straight and unpigmented.

Readily distinguished from *A. celatus* by the lack of accessory elytral tubercles and from *A. io* by its less erect setae, notably on the antennal scape. Clean specimens can be distinguished from *A. occultator* by the larger and more numerous scales on their mesepisterna.

Apirocalus (Molobrium) terrestris terrestris subsp. n.

(Figs 78, 105, 107–110; Map 2)

Range. Eastern, Western and Southern Highlands. Altitude: 1500–2500 m.

Length 4·6–5·9 mm ($\bar{x}$ (22) = 5·2). Scales appear dull brown but are bronzy, coppery or pearly when clean, sometimes forming a variegated pattern on elytra; TSI 40–51 ($\bar{x}$ (12) = 45).

Genitalia. Median lobe of aedeagus (Figs 107–110) ×2·1–2·2 as long as broad; flagellum as long as median lobe.

Holotype ♂, PAPUA NEW GUINEA: Eastern Highlands, Okapa, *c.* 5000 ft [1500 m], Station No. 185, 10–11.ii.1965 (*M. E. Bacchus*), in BMNH.

Paratypes. PAPUA NEW GUINEA: 1 ♂, same data as holotype except Station No. 170 and 4–15.ii.1965; 1 ♀, Wanatabe Valley, near Okapa, Station No. 174, 5.ii.1965 (*M. E. Bacchus*) (both BMNH); 1 ♂, Purosa, 1700 m, 17–25.v.1966 (*Gressitt & Tawi*) (BPBM); 3 ♂, 6 ♀, Aiyura, 1600 m, 25.ix.1972 (*A. J. Kimber*) (6 DAPM, 3 BMNH); 1 ♂, 2 ♀, same locality, 5400 ft [1620 m], 20.ii.1958 (*J. H. Barrett*) (2 DAPM, 1 BMNH); 1 ♂, ditto except 30.x.1954 (*A. Schindler*); 1 ♀, same locality, 6000 ft [1800 m], 23.x.1954; 1 ♀, Oyihaka Pltn, 5400 ft [1620 m] (no date); 1 ♂, Goroka, 5200 ft [1560 m], 29.x.1954 (all *Szent-Ivany*) (all DAPM); 3 ♂, Goroka, G. Pentland's plantation, 5200 ft [1560 m], 26.iv.1955 (*Szent-Ivany*) (2 DAPM, 1 BMNH); 2 ♂, 1 ♀, Western Highlands, Nondugl, 1.xii.1950 [*W. W. Brandt*] (ANIC); 1 ♂, Hagen Town, 4° 43′ S, 144° 17′ E, 1650 m, 30.v.1966 (*Gressitt*); 2 ♂, Lake Sirunki, 14 and 16.vi.1963; 1 ♀, Yaibos, 2200–2150 m, 10.vi.1963; 1 ♀, 6–12 km W of Wabag, 2020–2400 m, 13.vi.1963; 1 ♂, Kepilam, 2450–2600 m, 22.vi.1963 (all *J. Sedlacek*) (all BPBM); 1 ♂, 1 ♀, Kandep area, slope above Lai river valley, *c.* 7800 ft [2340 m], 16.ii.1964; 1 ♂, Southern Highlands, Mendi, Methodist Mission Station, 5000 ft [1500 m], 14.ix.1960 (all *Szent-Ivany*) (all DAPM).

Specimens examined: 35; dissected: 13 (9 ♂, 4 ♀).

Bionomic data. 'Feeding on ripe strawberries' (Aiyura, AJK); ' x soil' (Aiyura, JHB); 'On ground under coffee bush' (Goroka, S-I); 'Feeding on sweet potato foliage' (Lai river valley, S-I); 'Orn. garden, on *Euphorbia pulcherrima*' (Mendi, S-I); 'On coffee (suspected ring-borer)' (Oyihaka Pltn, S–I; Aiyura, AS).

The smallest member of the genus. Its range is unusually extensive for a montane taxon but no localized variation has been detected.

Apirocalus (Molobrium) terrestris dissidens subsp. n.

(Figs 106, 111, 112; Map 2)

Range. Star Mts. Altitude: 1200–*c.* 2000 m.

Length 5·9–6·3 mm. Scales mainly pale grey or greenish when clean. TSI 45–50 ($\bar{x}$ (7) = 47). Otherwise resembles nominate subspecies.

Genitalia. Median lobe of aedeagus (Figs 111, 112) ×2·3–2·4 as long as broad, apex more distinctly truncate than in nominate subspecies; flagellum ×0·8 as long as median lobe.

Holotype ♂, IRIAN JAYA: Star Mts, Sibil, 1260 m, 2.v.1959 (*Leiden Mus. Neth. N. G. Exp.*), in RNH.

Paratypes. IRIAN JAYA: 1 ♂, same data as holotype except 17.v.1959 (RNH); 1 ♀, ditto except 2.vi.1959 (BMNH); 1 ♂, Beta Bip, Kampong, 1320 m, 11.iv.1959 (*Leiden Mus. Neth. N. G. Exp.*) (RNH). PAPUA NEW GUINEA: 2 ♂, West Sepik District, Eliptamin Valley, 1665–2530 m, 19.vi.1959 (*W. W. Brandt*) (BPBM, BMNH); 1 ♀, Feramin, 150–120 m [?], 23–31.v.1959 (*W. W. Brandt*) (BPBM).

Specimens examined: 7; dissected: 3 (2 ♂, 1 ♀).

In spite of its greater size, I regard this taxon as a subspecies of *A. terrestris* because the differences between their aedeagi are slight compared with those between the aedeagi of the other members of the subgenus.

Subgenus *APIROCALUS* Pascoe

Apirocalus Pascoe, 1881 : 590. Type-species: *Apirocalus cornutus* Pascoe, by monotypy.

Small to medium-sized species (5·5–12·0 mm). Elytral processes vary greatly between the species and often exhibit strong sexual dimorphism; they usually arise from sides of elytral declivity and diverge strongly postero-laterad. Although typically elongate and flattened, they are often very short or represented by obtuse angulations (especially in ♀); no accessory processes present but base often swollen or with a rounded swelling on inner (mesal) aspect. Antennal scape varies greatly (Figs 4–15); funicle and tarsi sometimes with scales. Ventrite 1 simple in both sexes; ventrite 5 sometimes foveate, especially in ♂. Median lobe of aedeagus variable (especially between species-groups), without or (rarely) with *sharp* admedian carinae on its upper surface; flagellum and spermatheca variable (see under species-groups).

This subgenus has the same range as the genus as a whole (p. 195, Map 1) and occurs over the same range of altitude.

It is doubtful whether the marginal elytral processes of this subgenus are homologous with the admedian processes of subgenus *Molobrium*. The basal swellings referred to above occupy the same position as the admedian processes of *Molobrium* but the relationship between these structures is uncertain.

The *fallax*-group

Elytra typically with very short angular processes, each with a rounded swelling on its meso-dorsal aspect (sometimes indistinct). Surface of elytral disc ± uneven and often with shiny bead-like granules on both striae and interstriae. Prothorax about as long as broad in both sexes, disc of pronotum slightly more strongly granulate in ♀ than in ♂ (on average). Antennal club ×0·3–0·4 as long as pronotum; scape slender, often crooked, apex either simple or capitate; setae on fore edge stiff, erect or suberect, mostly longer than greatest diameter of scape in middle of length, similar to those on funicle but stouter and blunt-tipped; scales on scape much smaller than those on pronotum; funicle segments without scales, tarsi rarely with a few scales on segment 2. Arms of mesosternum and mesepisterna with scales; mesepisterna strongly punctured. Median lobe of aedeagus ×1·8–3·0 as long as broad and ×0·5–0·6 as long as pronotum, moderately to very strongly curved, apical region strongly tapering, tip rounded or weakly spatulate, upper surface sometimes with a pair of sharp admedian carinae; struts ×2·7–3·4 as long as median lobe and ×1·5–1·8 as long as pronotum; flagellum short, ×0·4–0·7 as long as pronotum. Spermatheca linear, tail short, strongly reflexed; gland-lobe cylindrical, its axis making only a small angle with that of body; gland small, claviform; duct much longer than spermatheca. Styli of ovipositor ×3·8–5·5 as long as broad.

This group resembles subgenus *Molobrium* in general appearance and in combining close external similarity with strong genitalic differences. The proportions of the male genitalia are quite similar to those of the *io*-group of subgenus *Molobrium*. Two of the three known species are new.

Apirocalus (Apirocalus) fallax sp. n.

(Figs 4, 32–37, 113–117, 123–125; Map 4)

Range. Morobe District and Owen Stanley Range. Altitude: 800–1950 m.

Length 6·2–7·5 mm ($\bar{x}$ (25) = 7·0). Head, body, coxae and tarsi black or reddish black; antennae, trochanters, femora and tibiae very dark red. Scales on head, body and legs usually bright rust-brown but sometimes bronzy or greenish. *Head* and *rostrum* as in *A. io* except dorsal surface of rostrum transversely convex behind antennal insertions (not flat), pterygia less prominent and with their rims produced postero-ventrally to level of lower margins of eyes; setae on squamose areas smaller, inconspicuous. *Antennae* with funicle segments 1 and 2 subequal and *c.* ×2·5 as long as broad; segments 3–7 subequal (4 and 5 shortest) and ×1·1–1·8 as long as broad, widening progressively (but very slightly) towards apex; club ×2·1–2·5 as long as broad, widening evenly from base; scape varying from almost straight to distinctly sinuous or crooked, thickening (dorso-ventrally) in apical third but widening only a little, or not at all, beyond basal fourth; apex ± distinctly capitate; upper surface with very fine longitudinal rugulae and small setiferous granules, between and around which lie small ovate scales (usually about

half as large as those on pronotum), leaving the raised surfaces exposed; setae on fore edge brown, often fully erect, weakly curved, the longest exceeding greatest diameter of scape in middle of length (Fig. 4); setae on hind edge about half as long, subrecumbent; recumbent silky hairs absent or very sparse on funicle segments 1–5, more numerous on 6 and 7. *Prothorax* widest about middle, there moderately rounded, tapering evenly to apex and almost as strongly to base (often weakly and smoothly constricted in basal third); disc broadly flattened in basal two-thirds, its surface uneven, with numerous bead-like granules of various sizes, the largest ×2 (in some specimens)–4·7 diameter of surrounding scales, concentrated near mid-line and often divided by traces of a median furrow; scales lying densely and awkwardly in the deep depressions between granules and rugae; sides of prothorax with very large, fairly regular punctures and no granules; scales here ± imbricate in upper part, becoming sparse below level of widest point and dense again around fore coxae; setae brown or whitish, much smaller than those on antennal scape, subrecumbent and inconspicuous. *Elytra* subovate, disc ± flattened, its surface uneven, with a ± distinct elevation on basal part of interstria 3 (or 3–5) and another (sometimes) on intermediate part of 7; elytral processes very short, their angulate or rounded edges projecting subhorizontally from interstria 5; basal swellings (in interstriae (2–)3–4) variably developed (sometimes obsolete), their centres about level with apices of processes (Figs 32, 36); striae well marked in spite of surface irregularities, interstriae 3 and 5 distinctly broader than 2 and 4; granulation of disc varies from small (scale-sized) setiferous granules on interstriae only, to larger granules (< ×3 diameter of scales) on both interstriae and striae, those on former often irregular in size and arrangement; scales separate on disc, contiguous on declivity and processes, condensed and often imbricate at base of interstria 6; scales on sides vary in size and density and are apparently subject to abrasion by legs; setae linear or linear-lanceolate, semi-erect, brown, pale brown or whitish, small and inconspicuous on disc, larger near sides and varying greatly in size on each interstria, from same length as those on femora to twice as long; those on declivity intermediate in length, white around apex; processes with a tuft or fringe of very long, soft, linear-lanceolate, bright pearly setae. *Mesepisterna* strongly punctured and with a cluster of contiguous scales in posterior part, about as large as those on adjacent part of elytra; arms of mesosternum occasionally punctured and with a few similar scales. *Metasternum* and ventrites 1 and 2 with small ovate well separated scales in middle, becoming much larger, round and contiguous towards sides (those near sides of metasternum often larger than those on elytra); ventrite 5 with some small scales; ventrites 3 and 4 with few, if any, scales; setae semi-erect, whitish, similar to those on femora but finer. *Legs* with femora moderately swollen, middle and sometimes hind femora weakly curving dorsad, fore femora often weakly curving ventrad; fore tibiae distinctly to strongly incurved towards apex, middle tibiae not, or weakly, incurved, hind tibiae straight; hind tarsal claw-segment ×1·8–2·1 as long as segment 3; exposed parts of femora and tibiae with contiguous or subcontiguous scales, often larger and brighter on or beneath femoral swelling; setae curved, whitish, semi-erect (recumbent on knees), often arising from very small bead-like granules. *Sexual dimorphism* moderate; ventrite 5 of ♂ with large crater-like fovea, its rim formed posteriorly by edge of ventrite, laterally by a pair of posteriorly diverging carinae, with a gap anteriorly between ends of these carinae; ventrite 5 of ♀ often with traces of same fovea and carinae. Elytral processes of ♂ distinctly angulate, usually wider than elytra and separated from widest part of elytra proper by a constriction (Fig. 32); processes of ♀ rounded, usually narrower than widest part of elytra and often not projecting laterad (Fig. 36); EPI 106–121 (♂), 96–110 (♀).

Genitalia. Median lobe of aedeagus (Figs 113–117) ×0·5–0·6 as long as pronotum, ×1·9–2·3 as long as broad and very strongly arched; the cariniform sides in apical region unite across middle so that phallotreme lies in a deep, sharply defined, U-shaped depression; struts ×2·9–3·4 as long as median lobe; manubrium about as long as median lobe; flagellum *c.* ×0·7 as long. Spermatheca (Figs 123–125) varies little; gland small; duct ×2–3 overall length of spermatheca; spout straight, unpigmented; terminal chamber of bursa elongate.

Holotype ♂, Papua New Guinea: Owen Stanley Range, Goilala, Tororo, 1560 m, 15–20.ii.1958 (*W. W. Brandt*), in BPBM.

Paratypes. Papua New Guinea: 1 ♂, same data as holotype (BMNH); 3 ♀, Goilala, Bome, 1950 m, 24.ii–7.iii.1958 (*W. W. Brandt*) (2 BPBM, 1 BMNH); 1 ♀, same data except 16–31.iii.1958; 1 ♂, 1 ♀, ditto except 16–30.iv.1958 (all BPBM); 1 ♂, Goilala, 12 mls N. of Tapini, Perumeva, *c.* 4500 ft [1350 m], 14.vi.1962 (*Szent-Ivany, F. H. A. Kleckham & I. B. Pendergast*) (DAPM); 1 ♂, 2 ♀, Goilala, Metsialavava Pltn, 5000 ft [1500 m], 16.vi.1962 (*Szent-Ivany*) (2 DAPM, 1 BMNH); 1 ♂, 1 ♀, Morobe Dist., Garaina, 800 m, 16.i.1968 (*J. Sedlacek*); 1 ♀, Morobe Dist., Wau, 1200–1300 m, 22.x.1965 (*J. Sedlacek*) (both BPBM); 2 ♀, Wau, 1200 m, 23.ii.1966 (*J. Sedlacek*) (BPBM, BMNH); 1 ♀, Wau, 8.ix.1968 (*I. Loksa*) (TM); 1 ♀, Wau, Kujeru, 1500 m, 27.ix.1969 (*A. B. Mirza*); 1 ♀, Wau, Nami Creek, 1700 m, 17.v.1965 (*J. Sedlacek*) (both BPBM);

2 ♀, same data except 1700–1850 m and ii.1966 (BPBM, BMNH); 1 ♂, 2 ♀, Nami Creek, 22.viii.1968 (*J. Balogh*) (TM); 1 ♀, Wau, Mt Missim, 1600 m, 17.iii.1966 (*Gressitt*); 1 ♀, 'Missim 1.iii / 1650 m' [MS] (*J. & M. Sedlacek*) (both BPBM); 1 ♂, same locality, 22–24.iv.1965 (*J. Balogh & Szent-Ivany*) (TM).

Specimens examined: 28; dissected: 16 (8 ♂, 8 ♀).

Bionomic data. '[In] village garden, on *Phaseolus vulgaris* in dense popul[ation]' (Perumeva, S-I, *et al.*); 'Feeding on foliage of "Coffea arabica" ' (Metsialavava, S-I).

A wide-ranging species, distinguished only with difficulty from the following yet is itself highly variable, hence the name ('deceiver'). I have in this case chosen a dissected specimen as holotype to avoid any possibility of error.

Apirocalus (Apirocalus) insperatus sp. n.

(Figs 38, 39, 118–120; Map 4)

Range. Morobe District. Altitude: 1400–2350 m.

♂. Length 5·5–5·8 mm (2 specimens). Elytral processes acute, rising more steeply than in *A. fallax*; basal swellings indistinct (Figs 38, 39). Otherwise as in *A. fallax*.

Genitalia. Median lobe of aedeagus (Figs 118–120) ×0·54 and 0·57 as long as pronotum, ×2·28 as long as broad (single observation), moderately curved, apex weakly spatulate; struts ×2·74 as long as median lobe, manubrium ×0·9 as long (single observations); flagellum ×1·15 and 1·22 as long as median lobe, distinctly longer and stouter than in *A. fallax*.

Holotype ♂, Papua New Guinea: Morobe District, Mt Kaindi, 2350 m, 31.x.1966 (*G. A. Samuelson*), in BPBM.

Paratype. Papua New Guinea: 1 ♂, Morobe District, Wau, 1400 m, 17.vi.1961 (*J. Sedlacek*), in BMNH.

Both specimens have been dissected.

The smallest species of the nominate subgenus. Distinguished externally from *A. fallax* only by its larger and sharper elytral processes and smaller (average ?) size. The male genitalia are, however, unequivocally distinct; not only do the aedeagi differ markedly in shape but the flagellum in *A. insperatus* is longer than in *A. fallax* both relatively and in terms of actual length, although it is the smaller species (flagellum in *A. fallax* is 0·76 mm long and ×0·39 as long as pronotum; in *A. insperatus* it is 1·15 mm long and ×0·66 as long as pronotum).

The occurrence of two closely related species in the same locality is unusual and suggested the name of the present species ('unlooked-for'). If these species really do occur together, it may only be possible to recognize the female of *A. insperatus* by its longer spermathecal duct.

Apirocalus (Apirocalus) asper Marshall

(Figs 5, 81, 121, 122; Map 4)

Apirocalus asper Marshall, 1956 : 17, 20. Holotype ♀, Papua New Guinea (BMNH) [examined].

Range. Central District (near Tapini). Altitude: 1200 m.

Length 6·1–6·2 mm (2 specimens). Differs from *A. fallax* as follows. Tarsi not darker than tibiae; antennal club narrower on average (< ×2·8 as long as broad); scape thickening and widening apicad throughout, apex simple (not capitate), scales larger, setae on fore edge shorter, not exceeding greatest diameter of scape in middle of length; elytral striae less distinct, interstria 5 (in ♂) convex, forming a low carina, continuous with edge of fin; basal swellings distinct, lying entirely anterior to level of fin apices (not partly posterior to it); setae on elytra and legs smaller, linear or linear-lanceolate, those on elytra subrecumbent, mostly brown, the longest slightly longer than longest on scape; those on femora recumbent, pearly white, shorter than longest on scape. *Sexual dimorphism* very slight; ventrite 5 of ♂ with large fovea but sides rounded, not cariniform, as in *A. fallax*; ventrite 5 of ♀ with a small pre-apical fovea. Elytral processes angulate in both sexes, slightly larger in ♂ and wider than greatest width of elytra proper; processes in ♀ as wide as elytra; elytra in both sexes constricted at base of processes (cf. *A. fallax*); EPI 121 (♂); 114 (♀). Granulation of pronotum and elytra similar in both sexes.

Genitalia. Median lobe of aedeagus (Figs 121, 122) × 0·6 as long as pronotum, × 3·0 as long as broad, weakly arched, with a pair of sharp admedian carinae in basal third; struts × 3·0 as long as median lobe, manubrium about as long as median lobe, flagellum × 1·2 as long (all single observations); middle section of internal sac with dense field of pigmented claviform teeth (Fig. 81). Spermatheca, etc., not examined.

Holotype ♀, Papua New Guinea: Central District, Mafulu, 4000 ft [1200 m], i.1934 (*L. E. Cheesman*), with 'Apirocalus/asper, Mshl./TYPE ♀' (Marshall MS), in BMNH.

Paratype. 1 ♂, same data as holotype except Marshall's label reads 'COTYPE ♀' (BMNH).

Two specimens; the holotype has been cleaned and remounted but not dissected.

Once again, the male genitalia provide the only certain means of recognizing this species. The flagellum is about as long as that of *A. insperatus*.

The *avus*-group

Elytral processes short and angular or long and blade-like, with or without a rounded swelling at base on meso-dorsal aspect. Surface of elytral disc ± even, granulate or not. Prothorax about as long as broad, slightly broader than long in some females and slightly longer than broad in some males; disc granulate or not. Antennal club × 0·3–0·4 as long as pronotum; scape slender, ± sinuous, apex weakly to distinctly capitate; setae on fore edge variable, usually stiff and semi-erect but pointed and seldom exceeding greatest diameter of scape in middle of length; funicle segments without any scales, hind tarsal segments 1 and 2 sometimes with one or two scales. Mesepisterna and arms of mesosternum both with scales. Median lobe of aedeagus × 2·0–2·6 as long as broad and × 0·45–0·60 as long as pronotum, weakly curved in profile view, without any carinae or other elevations on upper surface, apex broadly rounded; struts × 2·4–3·3 as long as median lobe and × 1·3–1·8 as long as pronotum; flagellum varying in length, × 0·7–3·3 as long as pronotum. Spermatheca ± linear, tail strongly reflexed, often larger than body; gland-lobe small, its axis making only a small angle with that of body (sometimes indistinct); gland small, linear or claviform; duct × 1·7–4·7 overall length of spermatheca. Styli of ovipositor × 3–4 as long as broad.

Differs from the *fallax*-group in that the prothorax is more evenly rounded at sides and more evenly convex on disc (if disc is flattened, this area is quite undefined); granules variable and often divided along mid-line but rarely with any trace of a median furrow; elytral processes, in general, larger and usually blade-like in ♂. The greatest contrast with the *fallax*-group lies, however, in the almost exact similarity of the median lobe of the aedeagus throughout the group, coupled with great variation in the length of the flagellum; flagellar length tends to increase from west to east across the range of the group. This trend is not, apparently, reflected in the external characters of the species, the relationships of which are obscure.

Apirocalus (Apirocalus) subcostatus sp. n.

(Figs 40–43, 126, 127, 134, 135; Map 3)

Range. Eastern Highlands. Altitude: 1500–2200 m.

Length 5·6–6·9 mm ($\bar{x}$ (11) = 6·0). Entirely reddish black, femora and tibiae often more distinctly red, tarsi concolorous or darker; scales pale brown with golden reflexion or grey or greenish grey. ***Head*** and ***rostrum*** as in *A. avus* except fewer scales on head capsule below eye. *Antennae* with funicle segments 1 and 2 equal and twice as long as broad, segments 3–5 subequal and × 1·1–1·3 as long as broad, segments 6 and 7 similarly proportioned but slightly larger; club × 2·1–2·6 as long as broad, ovate; scape as in *A. avus* except longest setae on fore edge sometimes exceeding greatest diameter of scape in middle of length. ***Prothorax*** as in *A. avus* but granulation of disc of pronotum more variable, largest granules sometimes well separated and only × 2 diameter of surrounding scales but sometimes × 3 diameter of scales and crowded irregularly together near mid-line which may be marked by traces of a narrow median furrow. ***Elytra*** as in *A. avus* except interstriae 3, 5 and 7 often ± raised from near their bases to bases of processes, strial setae brown (not pale) and those on fin edges in ♂ not longer than in ♀. ***Mesepisterna*** etc. as in *A. avus*. ***Legs*** as in *A. avus* except fore and middle tibiae very weakly incurved throughout their length. ***Sexual dimorphism*** moderate; spread of elytral processes in both sexes not exceeding greatest width of elytra proper and each with a distinct swelling on meso-dorsal aspect; processes in ♀ very short and turned strongly laterad, so inner sides face posteriad and are in a line or make a very obtuse angle with each other (Fig. 42); processes in ♂ somewhat longer, varying in shape but angle between their

inner sides < one and one-half right angles, outer edges well marked, subparallel (sometimes narrowed at base) (Fig. 40); EPI 119–130 (♂), 103–119 (♀). Ventrite 5 of ♂ with crater-like fovea (as in *A. fallax*); ♀ with much weaker fovea.

Genitalia. Aedeagus etc. (Figs 126, 127) as in *A. avus* except flagellum × 1·4 as long as pronotum (single observation, Goroka). Spermatheca (Figs 134, 135) usually more compact than in *A. avus*; duct × 2·3–2·5 overall length of spermatheca.

Holotype ♀, Papua New Guinea: Eastern Highlands, Mt Otto, 2200 m, 22.vi.1955 (*J. L. Gressitt*), in BPBM.

Paratypes. Papua New Guinea: 3 ♀, same data as holotype except 23.vi (2) and 24.vi (1) (2 BPBM, 1 BMNH); 1 ♀, Goroka, 1500 m, 23.v.1961 (*J. L. Gressitt*) with '3700' (MS) on separate label (BPBM); 1 ♂, same locality, G. Pentland's Pltn, 5200 ft [1560 m], iv.1955 (*Szent-Ivany*); 1 ♀, G. Greathead's Pltn, 7.iii.1961 (*J. H. Barrett*) (both DAPM); 1 ♂, 1 ♀, Asaro Valley, Miramar, 1800 m, 27.vi.1955 (*J. L. Gressitt*) (BPBM); 2 ♀, Okapa, Kamano, 28.i.1973 (*R. W. Hornabrook*) (RWH, BMNH); 2 ♂, Aiyura, 5400 ft [1620 m], 8 and 20.ii.1958 (*J. H. Barrett*) (DAPM, BMNH).

Specimens examined: 13; dissected: 7 (3 ♂, 4 ♀).

Bionomic data. 'Feeding on coffee foliage' (Goroka, S-I); 'x weeds' (G. Greathead's Pltn, JHB); '*G*[*revillea*] *robusta*' (Aiyura, JHB).

A very variable species; the raised interstriae, from which it takes its name, are strongly developed in some specimens but very weak in others.

Apirocalus (Apirocalus) avus sp. n.

(Figs 46–48, 50–55, 76, 128–131, 136–139; Map 3)

Range. Western, Southern and Eastern Highlands; Chimbu. Altitude: 1000–2700 m.

Length 5·1–7·7 mm. Black or reddish black, femora and tibiae usually distinctly red (tarsi darker); scale colour variable, brown, green, grey, pearly or coppery (paler on elytral declivity). *Head* and *rostrum* as in *A. fallax* except dorsal surface of rostrum less strongly narrowed behind antennal insertions and scales below eye extending on to head capsule. *Antennae* with funicle segments as in *A. fallax*; club × 2·1–2·9 as long as broad; scape as in *A. fallax* except scales not much smaller than those on pronotum and setae on leading edge often whitish, suberect and not exceeding greatest diameter of scape in middle of length, stouter and slightly shorter than those on funicle but ± finely pointed. *Prothorax* about as long as broad in ♀, similar to distinctly longer than broad in ♂, widest about middle, tapering more strongly to apex than to base (especially in ♂), without any pre-apical constriction; surface of disc of pronotum somewhat uneven, strongly and irregularly granulate, the largest granules near mid-line (and often divided along it by a clear space), their diameters < × 3 those of surrounding scales; scales ± contiguous throughout upper surface, larger and denser on sides, often imbricate below hind angles and on bulge above fore coxae; setae near sides < × 0·7 as long as those on leading edge of scape, those elsewhere inconspicuous. *Elytra* very broadly ovate (only slightly longer than broad in ♂), sides strongly and evenly rounded; disc flat in ♂, weakly convex in ♀, its surface even; striae clearly indicated by a row of bare punctures with, in front of each, a scale-sized bead-like granule, bearing on its posterior aspect a small pale seta which projects over the strial puncture but is shorter than the latter's diameter; interstriae 2–5 subequal in width, each with a single irregular row of very small granules, each bearing a blunt brown seta, about one-third (♂) to one-half (♀) as long as width of interstria in which it stands; setae near sides and on declivity longer, brown or white; edges of processes with fringe of soft, linear, finely pointed, pale brown or whitish setae, < × 2 as long as those on scape in ♀, < × 3 as long in ♂, usually pale in anterior part of fringe, grading to brown posteriorly; scales contiguous on upper surface and on fins, denser on sides, becoming imbricate in shoulder region and on declivity. *Mesepisterna* coarsely and irregularly punctured; arms of mesosternum, mesepisterna and mesepimera all with scales, either all similar (and similar to those on elytra) or those on mesepisterna smaller and/or duller, so that those on arms of mesosternum stand out as an isolated pale fleck. *Metasternum* and ventrites 1 and 2 ± densely squamose throughout and with very fine, pale, iridescent, erect or semi-erect setae; ventrite 5 with scattered smaller scales and smaller setae; ventrites 3 and 4 with a few small scales (in fresh specimens) and each with a single transverse row of setae. *Legs* with femora moderately swollen, ± straight (in side view) or with middle femora weakly curving dorsad; fore and middle tibiae very weakly incurved towards apex, hind tibiae straight; hind tarsal claw-segment × 1·9–2·3 as long as segment 3; scales on

exposed parts of femora and tibiae dense, those on widest part of femur larger, often imbricate and paler than rest; setae fine, curved, usually pointed, semi-erect, whitish, often with coloured reflexions, often arising from very small shiny granules; segments 1 and 2 of hind tarsi sometimes with one or two broad scales. *Sexual dimorphism* variable; elytral processes longer in ♂ than in ♀, their spread always exceeding greatest width of elytra proper, their inner margin swollen or not; processes of ♀ acute, their spread seldom exceeding greatest width of elytra proper.

Genitalia. Median lobe of aedeagus about half as long as pronotum, ×2·1–2·5 as long as broad; flagellum ×0·9–2·0 as long as pronotum. Spermatheca with duct ×2·0–3·4 its overall length.

Apirocalus (Apirocalus) avus avus subsp. n.

(Figs 52–55, 128, 129, 136, 137; Map 3)

Range. Eastern Highlands and Chimbu (Nomane). Altitude: 1500–2100 m.

Length, ♂: 5·4–7·4 mm ($\bar{x}$ (16) = 6·5); ♀: 6·0–7·7 mm ($\bar{x}$ (16) = 7·0). Prothorax about as long as broad in ♀, distinctly longer than broad in ♂; granules on disc of pronotum < ×2·5 diameter of surrounding scales. Setae near sides of elytra and on declivity at most about as long as those on leading edge of scape in ♀ but only one-half to two-thirds as long in ♂. *Sexual dimorphism* well marked; elytra of ♂ (Figs 52, 53) with well developed blade-like processes, tapering distad and with rounded apices, their lateral spread exceeding greatest width of elytra proper, distinctly rising from the horizontal but both lying in the same plane or only weakly tilted inwards, their inner sides straight or weakly sinuous but never with a distinct swelling, making a little more than a right angle with each other; outer third of blade compressed, forming a flange with well marked edge. Processes in ♀ (Figs 54, 55) shorter, not flattened, sharply angular, lateral spread not exceeding greatest width of elytra proper, their inner sides making about one and one-half right angles with each other (in antero-dorsal view) and their planes tilted inwards, making a right angle with each other (in posterior view); EPI 125–133 (♂), 112–122 (♀). Ventrite 5 of ♂ with crater-like fovea, that of ♀ simple.

Genitalia. Median lobe of aedeagus (Figs 128, 129) half as long as pronotum, ×2·1–2·4 as long as broad, weakly curved, apex ± evenly rounded; struts ×2·7–3·1 as long as median lobe, manubrium about as long as median lobe, flagellum ×2·4–2·6 as long and ×1·0–1·3 as long as pronotum, moderately curved throughout its length. Spermatheca (Figs 136, 137) with tail about as large as body; gland-lobe small but usually distinct, gland linear or claviform; duct-lobe elongate, variously flexed; duct about ×2·3 overall length of spermatheca; spout straight, sometimes pigmented.

Holotype ♂, Papua New Guinea: Eastern Highlands, Purosa, 1700 m, 17–25.v.1966 (*Gressitt & Tawi*), in BPBM.

Paratypes. Papua New Guinea: 29 ♂, 30 ♀, same data as holotype (49 BPBM, 10 BMNH); 4 ♂, 21 ♀, Purosa, 20–26 km SE. of Okapa, 1800–2020 m, 28.viii.1964 (*J. & M. Sedlacek*) (19 BPBM, 6 BMNH); 10 ♂, 18 ♀, Okapa, Purosa, 1700–2000 m, 18.i.1966 (*J. Sedlacek*) (26 BPBM, 2 BMNH); 1 ♀, Purosa, 2.xi.1964 (*R. W. Hornabrook*) (RWH); 3 ♂, 1 ♀, 24–26 km SE. of Okapa, 1800–1900 m, 25 and 27.viii.1964; 7 ♂, 8 ♀, 13 km SE. of Okapa, 1650–1870 m, 26.viii.1964 (all *J. & M. Sedlacek*) (all BPBM); 8 ♂, 8 ♀, Okapa, 1964–71 (various dates) (*R. W. Hornabrook*) (15 RWH, 1 BMNH); 2 ♂, 1 ♀, Okapa, *c.* 5000 ft [1500 m], Station No. 170, 4–15.ii.1965; 2 ♀, Wanitabe Valley, *c.* 5000 ft [1500 m], Station No. 174, 5.ii.1965 (all *M. E. Bacchus*) (all BMNH); 2 ♂, same locality, 11.x.1964; 1 ♂, Agakamatasa, 17.i.1965; 1 ♀, Konisitasa, 15.xi.1964 (all *R. W. Hornabrook*) (all RWH); 1 ♂, 1 ♀, Waisa, near Okapa, *c.* 5000 ft [1500 m], Station No. 193, 15.ii.1965 (*M. E. Bacchus*) (BMNH); 6 ♂, 9 ♀, Okapa, Okasa, 1400–1600(–1650) m, 16 and 17.i.1966 (*J. Sedlacek*) (13 BPBM, 2 BMNH); 2 ♂, 1 ♀, Moife, 15 km NW. of Okapa, 2100 m, 11–13.x.1959 (*T. C. Maa*) (BPBM); 1 ♀, Hegeturu [southern slopes of Mt Michael], 6700 ft [2010 m], 1962 (*L. B. Glick*) (BMNH); 1 ♂, Frigano [15 km E. of Lufa, 6200 ft [1860 m]], 15.vii.1972; 1 ♂, 3 ♀, Lufa, 1971–4 (various dates) (all *R. W. Hornabrook*) (4 RWH, 1 BMNH); 3 ♂, 2 ♀, 10 km NE. of Lufa, 1800–2100 m, 21.i.1966 (*J. & M. Sedlacek*) (4 BPBM, 1 BMNH); 1 ♂, 6 ♀, Arau, Gadsup, 12.ix.1972 (*R. W. Hornabrook*) (6 RWH, 1 BMNH); 1 ♂, 2 ♀, 20 km SW. of Kainantu, 1800 m, 16.i.1966 (*J. Sedlacek*); 1 ♂, 1 ♀, Kainantu, 1500 m, 20.i.1966 (*J. & M. Sedlacek*); 1 ♂, 2 ♀, Aiyura, 1800–1900 m, 6.i.1965; 1 ♀, Aiyura, 1700–1800 m, 9.i.1965 (all *J. Sedlacek*); 1 ♂, 1 ♀, same data except 5.i.1965 (♂) and (*J. L. Gressitt*) (both); 1 ♀, Kassem

Pass, 1400 m, 4.i.1965 (*J. & M. Sedlacek*) (all BPBM); 3 ♂, 2 ♀, Chimbu, Nomane, ix.1972 (*R. W. Hornabrook*) (4 RWH, 1 BMNH).

Specimens examined: 213; dissected: 16 (11 ♂, 5 ♀).

Apirocalus (Apirocalus) avus intermedius subsp. n.

(Figs 46, 47, 130, 131, 138, 139; Map 3)

Range. Western and Southern Highlands. Altitude: 1750–2700 m.

Length (5·1–)5·9–7·3 mm ($\bar{x}$ (20) = 6·6). Differs from the nominate subspecies as follows: scales on elytra sometimes coppery; antennal scape often widening ± evenly from near base to terminal swelling; club × 2·4–2·8 as long as broad, longer in ♂ than in ♀; prothorax slightly longer than broad in both sexes and largest granules on disc of pronotum < × 3 diameter of surrounding scales; elytra with larger granules along striae (on average); tarsi more often with scales: segments 1 and 2 of fore and middle tarsi sometimes with one or two scales on each, those of hind tarsi with up to four scales (in fresh specimens). *Sexual dimorphism* slight; elytral processes shorter in ♂ (Figs 46, 47) so ranges overlap: EPI 115–125 (♂), 112–119 (♀); ventrite 5 of ♂ ± distinctly foveate, that of ♀ simple or weakly foveate. Processes in ♂ strongly tapering, subacuminate, strongly diverging, with a ± well developed swelling on meso-dorsal aspect which imparts curvature to inner side, thus decreasing angle between bases (to about a right angle) while distal part of process appears to be reflexed laterad (in antero-dorsal view); spread usually distinctly exceeds greatest width of elytra proper. Processes in ♀ similar but shorter; angle between inner sides *c.* one and one-half right angles; spread about equal to greatest width of elytra proper.

Genitalia (Figs 130, 131, 138, 139) as in *A. a. avus* except flagellum longer, × 1·4–2·0 as long as pronotum (four observations), basal part strongly curved but not coiled into a ring; spermathecal duct × 2·0–3·4 overall length of spermatheca (three observations).

Holotype ♂, Papua New Guinea: Western Highlands, Yaibos, 2200–2150 m, 10.vi.1963 (*J. Sedlacek*), in BPBM.

Paratypes. Papua New Guinea: 1 ♂, 6 ♀, same data as holotype (5 BPBM, 2 BMNH); 1 ♀, Mt Hagen, 19.iii.1960 (*M. Levy*) (DAPM); 1 ♂, slopes of Mt Hagen, Tomba, 2450 m, 25.v.1963 (*J. Sedlacek*) (BPBM); 1 ♂, Tombi [Tomba], 7000 ft [2100 m], Lot No. 876, 3.vi.1974 (*J. N. L. Stibick*) (DAPM); 1 ♀, Baiyer River Sanctuary, 1–5.ix.1969 (*J. Balogh*) (TM); 1 ♀, 16 km NW. of Banz, 1700–2100 m, 28–29.vi.1963 (*J. Sedlacek*) (BPBM); 1 ♂, 2 ♀, Ahl Valley, Nondugl, 1750 m, 8.vii.1955 (*J. L. Gressitt*) (2 BPBM, 1 BMNH); 1 ♂, N[ondugl], 1.xi.[1950] [*W. W. Brandt*] (ANIC); 1 ♂, 1 ♀, Minj, 8–13.ix.1959 (*T. C. Maa*) (BPBM); 1 ♂, 1 ♀, Tambul, 9000 ft [2700 m], Lot No. 874 [vi.1974] (*J. N. L. Stibick*) (DAPM); 1 ♀, Kepilam, 2420–2540 m, 21.vi.1963 (*J. Sedlacek*) (BPBM); 2 ♂, 2 ♀, Kandep, 8000–8500 ft [2400–2550 m], 23.xii.1961–14.ii.1962 (*W. W. Brandt*) (3 ANIC, 1 BMNH); 1 ♂, 5 ♀, Southern Highlands, SE. of Mt Giluwe, Dimifa, 2200 m, 10, 11 and 12.x.1958 (*J. L. Gressitt*) (5 BPBM, 1 BMNH); 1 ♀, Rumpi, 14.x.1958 (*J. L. Gressitt*) (BPBM); 1 ♂, 1 ♀, Pangia, 17.vi.1975 (*R. W. Hornabrook*) (RWH).

Specimens examined: 35; dissected: 9 (6 ♂, 3 ♀). Females outnumber males by almost 2 : 1 in the above series.

This subspecies owes its name to the fact that it combines intermediate development of the elytral processes in the male with a flagellum of intermediate length.

Two females from the Jimi Valley (BPBM, ANIC) appear to belong to this subspecies but it would be desirable to check both sexes before extending the established range to include this area.

Apirocalus (Apirocalus) avus karimuicus subsp. n.

(Fig. 76; Map 3)

Range. Chimbu (Karimui). Altitude: 1000–1080 m.

Differs from the nominate subspecies in having a longer flagellum and broader prothorax in the male and a correspondingly longer spermathecal duct in the female. The figures are: flagellum × 1·5–1·8 as long as pronotum (five observations), basal part strongly curved but not forming a ring (Fig. 76); sperma-

thecal duct $\times 2.7$ and 3·3 overall length of spermatheca; prothorax of ♂ $\times 0.97$–1·04 as long as broad ($\bar{x}$ (15) = 1·01). The prothorax in fifteen males of the nominate subspecies (from Purosa) was $\times 1.04$–1·17 as long as broad ($\bar{x}$ (15) = 1·08).

Holotype ♂, PAPUA NEW GUINEA: Chimbu, Karimui, 1080 m, 13.vii.1963 (*J. Sedlacek*), in BPBM.

Paratypes. PAPUA NEW GUINEA: 6 ♂, 8 ♀, same data as holotype (9 BPBM, 5 BMNH); 3 ♂, 3 ♀, ditto except other dates between 8 and 15.vii.1963; 4 ♂, 2 ♀, Karimui, 1000 m, 4, 5 and 8.vi.1961 (*J. L. & M. Gressitt*); 1 ♂, Karimui, 4.vi.1961 (*J. L. Gressitt*) (all BPBM); 4 ♂, 1 ♀, Karimui, 1000 m, v.1969 (*H. Ohlmus*) (TM).

Specimens examined: 33; dissected: 7 (5 ♂, 2 ♀).

Apirocalus (Apirocalus) avus finisterrae subsp. n.

(Fig. 48; Map 3)

Range. Finisterre Range. Altitude: 1000–2550 m.

Differs from the nominate subspecies in having a slightly shorter flagellum in the male (on average) and longer elytral processes in both sexes. The figures are: flagellum $\times 0.9$–1·1 as long as pronotum (three observations); EPI 130–135 (♂); 117–129 (♀); processes of ♂ curving upwards and/or outwards; those of ♀ with spread exceeding greatest width of elytra proper (in one case (Fig. 48) closely resembling those of ♂ of nominate subspecies).

Holotype ♂, PAPUA NEW GUINEA: Finisterre Range, Wantoat, [1000 m], viii.1972 (*R. W. Hornabrook*), in BMNH.

Paratypes. PAPUA NEW GUINEA: 1 ♀, same data as holotype (RWH); 1 ♂, Moro, *c.* 5550 ft [1665 m], Station No. 78, 30.x–15.xi.1964 (*M. E. Bacchus*) (BMNH); 1 ♂, 1 ♀, Saidor, Matoko [1500 m], 6–24.ix.1958 (*W. W. Brandt*) (BPBM); 1 ♀, Komba (*Rev. L. Wagner*) (SAM).

Specimens examined: 6; dissected: 4 (3 ♂, 1 ♀).

Apirocalus (Apirocalus) avus marawakanus subsp. n.

(Figs 50, 51; Map 3)

Range. Eastern Highlands (Marawaka). Altitude: *c.* 1500 m.

Differs from the nominate subspecies in having a broader prothorax (as in subsp. *karimuicus*) and longer setae on the elytra (setae near sides as long as those on leading edge of scape in ♂, longer than this in ♀); spread of elytral processes of ♀ distinctly less than greatest width of elytra which are not, or only weakly, constricted at process bases (Fig. 51); processes of ♂ usually narrower than in nominate subspecies and elytra more strongly constricted at their bases (Fig. 50).

Holotype ♀, PAPUA NEW GUINEA: Eastern Highlands, Marawaka, vi.1974 (*R. W. Hornabrook*), in BMNH.

Paratypes. 1 ♂, 1 ♀, same data as holotype (RWH); 6 ♂, 1 ♀, ditto except v.1974 (4 RWH, 3 BMNH).

Specimens examined: 10; dissected: 3 (2 ♂, 1 ♀).

Bionomic data. 'In leaf litter.'

Two male specimens from Mt Piora (BPBM) may belong to this subspecies but have only very short setae on their elytra.

Apirocalus (Apirocalus) sedlaceki sp. n.

(Figs 6, 49, 132, 133, 140, 141, 245; Map 3)

Range. Morobe District. Altitude: 700–2400 m.

Length, ♂: 5·2–7·6 mm ($\bar{x}$ (22) = 6·4); ♀: 5·8–8·1 mm ($\bar{x}$ (21) = 6·9). Colour, scales, head, rostrum and antennae as in *A. avus*. *Prothorax* as long as broad in ♂ (Fig. 49), slightly broader than long (< 9: 10) in ♀, usually strongly rounded at sides; otherwise as in *A. avus*. *Elytra* as in *A. avus* except setae near sides (in interstriae 6 and 7) longer, in ♂ as long as those on leading edge of scape, in ♀ usually slightly longer, suberect and conspicuous. *Sterna* and ventrites as in *A. avus* except contrast between smaller (dull) scales on mesepisterna and larger (bright) scales on arms of mesosternum is greater and more constant (Fig. 245). *Legs* as in *A. avus*. *Sexual dimorphism* well marked; elytral processes as in *A. avus* but more variable in shape in both sexes, those of ♀ with or without a swelling on meso-dorsal aspect; EPI 124–135(–144) (♂), 111–123 (♀).

Genitalia as in *A. avus* except flagellum about twice as long (× 2·3–2·7 as long as pronotum) and coiled into a ring which is incapable of being straightened; apex of median lobe of aedeagus often (but not always) subtruncate (Fig. 132) (evenly rounded in *A. avus*); spermathecal duct × 3·3–4·8 overall length of spermatheca.

Holotype ♂, Papua New Guinea: Morobe District, Wau, Nami Creek, 1700–1850 m, 7.ii.1966 (*J. & M. Sedlacek*), in BPBM.

Paratypes. Papua New Guinea: 12 ♂, 10 ♀, same data as holotype (16 BPBM, 6 BMNH); 9 ♂, 5 ♀, same data except ii.1966; 3 ♂, 3 ♀, ditto except 1700 m and 17 and 22.v.1965; 2 ♀, ditto except 1700–1800 m and 17.xi and xii.1965; 8 ♂, 4 ♀, Nami Creek, 6 km W. of Wau, 1700 m, 12 and 15.vi.1962 (all *J. Sedlacek*) (all BPBM); 8 ♂, 7 ♀, Nami Creek, 22.viii.1968; 6 ♂, 1 ♀, Wau, Mt Kaindi, 24–25.viii.1968, 19–24.viii and 24.ix.1969 (all *J. Balogh*) (all TM); 39 ♂, 26 ♀, Mt Kaindi, 1500–2400 m, 1962–1969 (various dates) (*Sedlacek(s)*, *Gressitt(s)*, *G. A. Samuelson*) (61 BPBM, 4 BMNH); 2 ♂, Mt Kaindi, *c.* 8000 ft [2400 m], 16.iv.1965 (*Szent-Ivany*); 1 ♂, Mt Kaindi, *c.* 6000 ft [1800 m], 16.ii.1966 (*Rhonda M. Stevens & A. Fischle*) (all DAPM); 2 ♀, Mt Kaindi, 18.i.1970 (*F. R. Wylie*) (DFB); 26 ♂, 20 ♀, Wau, Edie Creek, 1700–2300 m, 1961–1966 (various dates) (*Sedlacek(s)*, *J. L. Gressitt*, *G. A. Samuelson*, *P. Shanahan*) (45 BPBM, 1 BMNH); 3 ♂, 2 ♀, Edie Creek, 7000 ft [2100 m], Station Nos. 6 and 19, 17 and 21.ix.1964; 3 ♀, Edie Creek, Bulldog Road, 9700 ft [2910 m], Station No. 13, 20.ix.1964 (all *M. E. Bacchus*) (all BMNH); 1 ♂, 2 ♀, Bulldog Road, 40 km S. of Wau, 2100–2800 m, 22–30.iv and 22–31.v.1969 (*Sedlaceks*); 1 ♂, Bulldog Road, 60 km S. of Wau, 2170 m, 1–7.v.1969 (*J. Sedlacek*); 1 ♂, Lake Trist, 1600 m, 21–26.xi.1966 (*G. A. Samuelson*); 9 ♂, 14 ♀, Wau, Big Wau Creek, 1200 and 1300 m, ix and xii.1965 (*P. Shanahan*); 4 ♂, 4 ♀, Big Wau Creek, 1300 m, 3.ii.1966 ; 1 ♂, 3 ♀, Wau Creek, 1100–1500 m, 28.iii and 6.v.1963 and 6.x.1965 (*J. Sedlacek*) (all BPBM); 1 ♂, 2 ♀, Wau Creek (no other data) (SAM); 1 ♂, head of Wau Creek, 5000 m [*sic*], 19.ix.1962 (*H. W. Clissold*); 5 ♂, 2 ♀, Wau, Kunai Creek, 1200–1250 m, 28.v.1964 and 15 and 28.v.1965 (*J. Sedlacek*); 10 ♂, 9 ♀, Wau, Hospital Creek, 1150–1300 m, 1965–1966 (various dates) (*Sedlacek(s)*, *P. Shanahan*); 1 ♂, Wau, Kujeru, 1500 m, 27.ix.1969 (*A. B. Mirza*); 1 ♂, Kilolo Creek, 7 km W. of Wau, 1070 m, 15–25.viii.1967 (*Tawi*) (all BPBM); 1 ♂, Kilolo Creek, 26.viii.1968 (*I. Loksa*); 7 ♂, Wau, McAdam Park, 18–21.iv.1965 (*J. Balogh and Szent-Ivany*); 1 ♂, McAdam Park, ix.1968 (*I. Loksa*) (all TM); 1 ♂, 1 ♀, McAdam Park, 1200–1300 m, 7.v.1965 (*J. Sedlacek*) (BPBM); 2 ♂, McAdam Park, 1200 m, 23.iv.1970; 2 ♂, Wau, Shanahan Pltn, 1200 m, 27.iv.1970 (all *J. N. L. Stibick*) (all CWO'B); 2 ♂, 1 ♀, Wau, Coviak Ridge, 763 m, 7.xii.1963 (*H. C[lissold]*); 1 ♀, 24–32 km SE. of Wau, 1500–1900 m, 20.iii.1962 (*J. Sedlacek*) (all BPBM); 4 ♂, 1 ♀, Wau, Bishop Museum Field Station, 15–25.iv.1965 (*J. Balogh & Szent-Ivany*); 2 ♀, Wau, 21–23.viii.1968 and 30.ix.1969 (*J. Balogh*) (all TM); 155 ♂, 205 ♀, Wau, 1000–1700 m, 1961–1969 (various dates and collectors) (335 BPBM, 25 BMNH); 1 ♂, 4 ♀, Wau, 15.ii.1966 (*Rhonda M. Stevens*) (DAPM); 2 ♂, 2 ♀, U[pper] Watut SW, 1100–2000 m, 30.iv.1968 (*J. L. Gressitt*); 1 ♀, Watut River, 900–1900 m, x.1959; 1 ♀, Upper Vatut [*sic*] River, 24 km W. of Bulolo, 760 m, 5–6.iii.1963 (both *J. Sedlacek*); 3 ♂, 3 ♀, Arabuka, 15[00]–2000 m, 7.i.1968 (*Sedlaceks*); 2 ♂, 1 ♀, Bulolo River, 1300 m, 17.ix.1969 (*A. B. Mirza*); 1 ♂, 3 ♀, Bulolo River, 800–1100 m, 21.vii, 24.viii and 25.ix.1965 (*E. J. Ford, Jr*); 1 ♂, 1 ♀, Bulolo, 700 m, 26.xi.1969 and 9.xi.1962 (*Sedlaceks*); 4 ♂, 5 ♀, Mt Missim, 950–2000 m, 1963–1966 (various dates and collectors) (all BPBM); 1 ♂, 2 ♀, Mt Missim (*Stevens*) (MCZ); 17 ♂, 8 ♀, Haus Copper, Wau, Mt Missim, 22–24.iv.1965 (*J. Balogh & Szent-Ivany*) (21 TM, 4 BMNH); 1 ♂, 1 ♀, Kuper Range, 700–1700 m, 24.i.1969 (*J. Sedlacek*) (BPBM); 1 ♂, 1 ♀, Morobe District, near Bainding Village [17 km NE. of Bulolo], *c.* 3000 ft [900 m],

14.iii.1967 (*T. L. Fenner & M. H[engeveld]*) (DAPM); 2 ♂, Asiki [Aseki] [60 km W. of Wau], 2000 m, xi.1972 (*J. Sedlacek, Reni*) (CWO'B).

Specimens examined: 730; dissected: 26 (17 ♂, 9 ♀).

A record for Garaina (BPBM) requires confirmation.

Bionomic data. 'On *Pipturus* sp.' (Mt Kaindi, FRW); 'Grasses' (Wau, JLG); 'In rainforest' (Bainding, TLF).

This species shows considerable variation in the shape of both the pronotum and the elytral processes. Specimens of either sex with a narrow pronotum closely resemble *A. avus*, while such females with swollen elytral processes resemble *A. intermedius*; males with normal pronotum but slender elytral processes can scarcely be distinguished (externally) from *A. avus finisterrae*. This species also occurs over an unusually wide range of altitude. Specimens from over 2500 m are above average size and the elytral processes of the males are abnormally long (EPI 134–144). The accompanying females have normal EPI's but the elytra are not narrowed before the process bases and the pronotum is as long as broad ($\times 0{\cdot}98$–$1{\cdot}04$; $\bar{x}$ (6) = 1·00).

Apirocalus (Apirocalus) suppuratus sp. n.

(Figs 44, 45, 142; Map 3)

[*Apirocaulus* (*sic*) *cornutus* Pascoe; Anonymous, 1965 : 109. Misidentification.]

Range. Owen Stanley Range (Woitape). Altitude: 1500–1800 m.

Length, ♂: 5·9–6·6 mm ($\bar{x}$ (18) = 6·2); ♀: (5·6–)6·2–7·3 mm ($\bar{x}$ (11) = 6·7). Black or reddish black, legs often more distinctly red (tarsi darker); scales pale brown or coppery, often with strong metallic reflexions (when clean). *Head* and *rostrum* as in *A. avus* except eyes less strongly convex and median rostral carina often (especially in ♀) very broad and flat, tapering posteriad and with a narrow median sulcus anteriorly. *Antennae* with funicle segments 1 and 2 × 2·0–2·5 as long as broad, 2 usually slightly longer than 1; segments 3–5 × 0·6 as long as 2 and × 1·3–1·4 as long as broad in ♂, × 0·9–1·3 as long in ♀; segments 6 and 7 of similar proportions but slightly larger (on average); club × 2·2–2·8 as long as broad, ovoid; scape as in *A. fallax* except setae on leading edge suberect, finely pointed, brown and white and seldom exceeding greatest diameter of scape in middle of length; funicle segments all with very fine recumbent silky hairs, larger and paler (hence more conspicuous) on segments 1 and 2. *Prothorax* as long as broad or very slightly longer (< × 1·04), widest about middle, sides evenly and moderately rounded, apex distinctly narrower than base; upper surface as in *A. avus* but usually with fewer, smaller granules (sometimes no larger than surrounding scales). *Elytra* as long as broad in both sexes, strongly and evenly rounded from base but only very slightly constricted before process bases; disc weakly convex, surface even or faintly rugose or with interstria 5 feebly raised; strial punctures largely obscured by scales, their associated granules (see *A. avus*) very small, often only half diameter of surrounding scales; interstrial granules smaller still; setae near sides and on declivity similar to those on leading edge of scape, those in process fringes up to twice as long, pearly white anteriorly, red-brown posteriorly (in various proportions); scales imbricate on upper part of sides and on declivity, elsewhere contiguous or subcontiguous. *Sterna* and venter as in *A. avus*. *Legs* as in *A. avus* except setae on femora a little stouter, whiter and subrecumbent. *Sexual dimorphism* slight; elytral processes in both sexes short, angular and each with a gross, abscess-like swelling on meso-dorsal aspect; those of ♂ (Figs 44, 45) usually wider than elytra proper, more flattened and with rounded apices; those of ♀ sharper, their outer sides subparallel or converging, usually (but not always) narrower than elytra proper; EPI 114–120 (♂), 100–116 (♀); ventrite 5 weakly or indistinctly foveate in both sexes, more broadly rounded in male; segments 3–5 of antennal funicle quadrate in ♀, longer than broad in ♂ (see above).

Genitalia as in *A. avus* except flagellum about three times as long (× 3·0–3·3 as long as pronotum) and coiled into a ring as in *A. sedlaceki*; spermathecal duct correspondingly long, × 4·7–5·3 overall length of spermatheca (three observations).

Holotype ♀, Papua New Guinea: [Owen Stanley Range], Goilala, Woitape, Iemi No. 2 village garden, *c.* 6000 ft [1800 m], 21.viii.1963 (*Szent-Ivany et al.*), B.M. 1963–672, in BMNH.

Paratypes. Papua New Guinea: 1 ♂, 6 ♀, same data as holotype (BMNH); 28 ♂, 13 ♀, same locality, 7.viii.1963 (*Szent-Ivany, I. Pendergast & A. Fauma*) (34 DAPM, 7 BMNH); 2 ♂, Iemi No. 1 village gardens, 6000 ft [1800 m], 22.viii.1963 (*Szent-Ivany*); 1 ♂, 1 ♀, Yemi [*sic*] village, 14.x.1963 (*L. Smee*); 3 ♀, Woitape, native garden, 14.16 [x].1963 (*L. Smee*); 1 ♂, 1 ♀, Woitape,

5000 ft [1500 m], 3.ix.1963 (*Szent-Ivany*) (all DAPM); 1 ♂, 1 ♀, Woitape, 1500–1750 m, 2–3.xi.1965 (*J. Sedlacek*) (BPBM); 1 ♀, Woitape, Kosipe, iv.1969, A. C. Allyn coll. (FMNH).

Specimens examined: 61; dissected: 10 (5 ♂, 5 ♀).

Bionomic data. 'On *Solanum*' and 'On *Solanum tuberosum* in dense population' (Iemi villages, S-I); 'Feeding on *Coffea arabica*' (Woitape, S-I).

A distinctive species (small males may, however, resemble male of *A. subcostatus*), presently known from a very restricted area. A record for Brown River (DAPM) requires confirmation.

Apirocalus (Apirocalus) canus sp. n.

(Fig. 143; Map 3)

Range. Owen Stanley Range (western end). Altitude: 900–2200 m.

Length, ♂: 6·1–7·4 mm ($\bar{x}$ (20) = 6·7); ♀: 6·3–8·2 mm ($\bar{x}$ (20) = 7·0). Black or reddish black, legs and antennae reddish black; scales mainly pale brown (rarely greenish); setae mainly white or hyaline (including those on antennal funicle). *Head* and *rostrum* as in *A. avus* except median rostral carina usually ill-defined or indistinct. *Antennae* with proportions of funicle segments and club as in *A. fallax*; scape as in *A. avus* but varying in both shape and width and strongly thickening in apical third; setae on leading edge white, often blunt, ± strongly curved, semi-erect; setae elsewhere smaller (on average) and less strongly raised, often all white but sometimes a few recumbent brown ones along middle of upper surface (very inconspicuous); recumbent silky hairs present on all funicle segments (larger and denser than in *A. avus*). *Prothorax* as long as or slightly longer than broad (< × 1·08 as long in ♂), widest in, or slightly in front of middle, tapering more strongly to apex than to base; granules on disc of pronotum < × 4 diameter of surrounding scales, sometimes divided along mid-line by a clear space; otherwise as in *A. avus*. *Elytra* as in *A. avus* except surface usually with weak irregular transverse rugae and strial granules usually larger than surrounding scales (< × 2·3 their diameter); setae near sides white, recumbent and inconspicuous; setae in process fringes < × 3–4 as long as those on leading edge of scape (in both sexes), mainly white; scales subcontiguous on disc, not concealing integument completely, becoming imbricate (and sometimes paler) along interstria 7 and on declivity. *Mesepisterna* coarsely punctured and arms of mesosternum smooth (as in the other species) but scales, when present, always few, dull brown and smaller than those on elytra (not forming a pale fleck on arms of mesosternum). *Metasternum* and venter as in *A. avus*. *Legs* with femora as in *A. avus*; fore tibiae weakly incurved towards apex, middle tibiae weakly incurved throughout, hind tibiae straight; scales on femora usually uniform, subcontiguous; setae fine but blunt, white and subrecumbent; segments 1 and 2 of hind tarsi sometimes with 1–4 small pearly scales. *Sexual dimorphism* not well marked; elytral processes of ♂ similar to those of *A. avus*; those of ♀ shorter and with their planes tilted more strongly inwards but similar in shape and with similar apical fringe of setae; EPI 125–133 (♂); 118–126 (♀); ventrite 5 simple in both sexes.

Genitalia as in *A. avus* except flagellum about three times as long (× 3·1–3·3 as long as pronotum) and coiled into a ring as in *A. sedlaceki* and *A. suppuratus*; spermatheca (Fig. 143) as in *A. sedlaceki* but relatively larger, hence, although duct is only × 3·7–4·5 overall length of spermatheca (within range of *A. sedlaceki*), it is in fact longer – *A. sedlaceki*: 2·4–3·1 mm; *A. canus*: 3·3–4·5 mm.

Holotype ♂, Papua New Guinea: Owen Stanley Range, Goilala, Bome, 1950 m, 8–15.iii.1958 (*W. W. Brandt*), in BPBM.

Paratypes. Papua New Guinea: 11 ♂, 11 ♀, same locality as holotype (17 BPBM, 5 BMNH); 3 ♂, 6 ♀, ditto except 24.ii–7.iii.1958 (7 BPBM, 2 BMNH); 1 ♂, ditto except 16–30.iv.1958 (BPBM); 7 ♂, 5 ♀, Goilala, Tororo, 1560 m, 15–20 and 21–24.ii.1958 (*W. W. Brandt*) (10 BPBM, 2 BMNH); 1 ♀, Goilala, Loloipa, 1–15.ii.1958; 1 ♂, 1 ♀, Goilala, Tapini, 975 m, 16–25.xi.1957 (all *W. W. Brandt*); 1 ♀, Tapini, 1000 m, 9–12.vii.1968; 3 ♀, Mt St Mary, 1900 m, 8–14 and 15–21.vii.1968 (all *Mena*); 1 ♀, Iongai, 10 km E. of Mt Albert Edward, 1450 m, 7.xi.1965; 1 ♀, Iongai, 1700–1900 m, 9.xi.1965 (both *J. Sedlacek*) (all BPBM); 1 ♂, 3 ♀, Goilala, Metsialavava Pltn, 5000 ft [1500 m], 16.vi.1962; 1 ♀, Goilala, Perumeva, 12 ml [19 km] N. of Tapini, village garden, 4500 ft [1350 m], 14.vi.1962 (both *Szent-Ivany*); 1 ♀, ditto except (*Szent-Ivany, F. H. A. Kleckham & I. B. Pendergast*); 2 ♂, Kamulai, 50 ml [80 km] NNW. of Tapini, 2200 m (no further data) (all DAPM); 3 ♂, 4 ♀ [Tapini], Mafulu, 4000 ft [1200 m], i.1934; 1 ♂ [Tapini], Mondo, 5000 ft [1500 m], i–ii.1934; 1 ♀ [Kokoda, near The Gap], Orrori, 3000 ft [900 m], vii.1933; 1 ♀ [Kokoda ?], Oquali, 4000 ft [1200 m], vii.1933 (all *L. E. Cheesman*) (all BMNH).

Specimens examined: 72; dissected: 6 (3 ♂, 3 ♀).

Bionomic data. 'On sweet potato' and 'Feeding on leaves of "Coffea arabica" ' (Metsialavava, S-I); 'On pumpkin' (Perumeva, S-I); 'On *Phaseolus vulgaris* in dense population' (Perumeva, S-I *et al.*).

The combination of prominent bead-like granules on the elytral striae with the predominance of white setae on the antennal scape and the lack of a pale fleck on the arms of the mesosternum distinguish this species from its relatives. In addition, the median rostral carina is often (though not always) virtually absent and the granules on the pronotum are, on average, larger than in the other species of the group.

The *granulicollis*-group

Apirocalus (Apirocalus) granulicollis sp. n.

(Figs 144–146, 239, 240; Map 3)

Range. Morobe District (Saruwaged Range). Altitude: 1350–1920 m.

Length 7·5–8·8 mm. Head and body black, femora, tibiae and antennal funicle black or reddish black; scales on pronotum and elytra partly, sometimes predominantly, pale green; elsewhere mainly pearly with coppery reflexion. *Head* and *rostrum* as in *A. avus* but relatively wider, eyes more widely separated (on average) and dorsal surface of rostrum broader, flatter and more distinctly expanded over scrobes; median rostral carina distinct but often abbreviated posteriorly. *Antennae* with funicle segments 1 and 2 subequal and × 2·0–2·5 as long as broad; segments 3–7 subequal, × 1·5–2·0 as long as 2 and × 1·1–1·7 as long as broad (5 shortest, 7 longest); club × 2·7–3·1 as long as broad, fusiform; scape almost straight, widening slightly from base to near apex, thickening in apical third and with a weak pre-apical constriction on leading edge only (subcapitate); sculpture as in *A. fallax*; setae on leading edge brown or pearly white, moderately curved, semi-erect, blunt-tipped, shorter than greatest diameter of scape in middle of length; funicle segments with recumbent silky hairs. *Prothorax* as long as broad, widest in or in front of middle; sides there strongly rounded, tapering ± evenly to base, more strongly to apex and with a ± distinct pre-apical constriction; upper surface with round shiny bead-like granules, more numerous and more regularly spaced than in *A. avus* and not divided along mid-line, the largest × 3–4 diameter of surrounding scales; scales contiguous between granules, much larger and imbricate on upper part of sides; setae near sides smaller than those on leading edge of scape, recumbent and inconspicuous. *Elytra* ovate, *c.* × 1·2 as long as broad, declivity almost vertical, disc almost flat transversely, weakly convex in profile view; surface even, or with faint transverse rugae; strial punctures small and ill-defined but mostly not concealed by scales and with large associated granules (< × 2 diameter of scales) as in *A. canus*; each interstria with a single rather irregular row of much smaller (< scale-size) granules, each bearing a blunt, brown or white seta, its length equal to one-third to half width of interstria, even near sides (cf. *A. avus*); setae in process fringes × 3 as long as those on scape, pearly white, grading to red-brown at apex; scales contiguous along interstriae on disc, imbricate on interstriae 7 and 8 but sparse on sides below processes and near costal margin; scales on meso-dorsal aspect of processes (and on intervening part of declivity) small and brown, forming a sombre transverse band which, in clean specimens, contrasts with bright scales further down declivity. *Mesepisterna* coarsely and irregularly punctured and with a few small scales at posterior end; arms of mesosternum smooth and with a ± extensive patch of large, bright, pearly scales which therefore stand out as an isolated pale fleck (as in *A. sedlaceki*, etc.). *Metasternum* and venter as in *A. avus* except ventrites 3 and 4 with setae irregularly disposed (not forming a single transverse row on each). *Legs* stouter than in *A. avus*; femora more strongly swollen; fore tibiae strongly incurved towards apex, middle tibiae moderately incurved, hind tibiae straight or very weakly incurved towards apex; hind tarsal claw-segment about twice as long as segment 3; scales as in *A. avus*; setae mainly white or hyaline, those on femora blunt, weakly curved and subrecumbent; those on tibiae finely pointed, weakly curved and suberect on inner (ventral) aspect becoming shorter, blunt, strongly curved and recumbent on outer (dorsal) aspect; no scales observed on tarsi. *Sexual dimorphism* well marked; elytral processes of ♂ similar to those of *A. avus* (♂) except elytra not, or very little, narrowed at fin bases (Fig. 239); processes of ♀ variable, well developed and with marginal fringe as in ♂ but strictly horizontal, their outer sides subparallel or curving mesad (narrower than greatest width of elytra proper), their inner sides either straight, simple, making an acute angle or each with a gross, elongate swelling which may reach almost to apex and impart a U-shape to space between processes (Fig. 240); EPI 144 (♂), 139–143 (♀); ventrite 5 of ♂ with pair of ill-defined longitudinal carinae (clearly derived from crater-like fovea of related species); carinae present, but less well developed, in ♀.

Genitalia. Median lobe of aedeagus (Figs 144, 145) similar to that of *A. avus*, × 0·6 as long as pronotum and × 2·6 as long as broad; struts × 2·4 as long as median lobe, manubrium as long as median lobe, flagellum × 1·3 as long and × 0·7 as long as pronotum, moderately curved throughout its length. Spermatheca (Fig. 146) with additional, blind, lobe opposite gland lobe; tail cylindrical (not tapering), apex bluntly rounded; duct × 1·9 overall length of spermatheca.

Holotype ♀, PAPUA NEW GUINEA: Morobe District, Salawaket [=Saruwaged] Range, Baindoang [Baindoung], 1800 m, 15.ix.1956 (*E. J. Ford, Jr*), in BPBM.

Paratypes. PAPUA NEW GUINEA: 1 ♀, same data as holotype (BMNH); 2 ♂, Salawaket Range, Sepalakambang [Seperagambang], 1920 m, 11.ix.1966 (*E. J. Ford, Jr*) (BPBM, BMNH); 1 ♀, Salawaket Range, Tuwep [Tewep], 1350 m, 8.ix.1956 (*E. J. Ford, Jr*) (BPBM).

Specimens examined: 5; dissected: 3 (1 ♂, 2 ♀).

Distinguished from the *avus*-group by the well developed and swept-back elytral processes of the female; the male somewhat resembles the male of *A. sedlaceki* but is larger and has more elongate elytra. The prominent granules on the pronotum and elytra, the green scales and the fact that it occurs in the Saruwaged Range, suggest an affinity with the *nivosus*-group. The additional lobe of the spermatheca is unique.

The *nivosus*-group

Elytral processes usually well developed but their spread less than, to only slightly greater than, greatest width of elytra proper. Antennal scape flattened, ± straight, apex simple or subcapitate; setae on fore edge suberect, distinctly shorter than greatest diameter of scape in middle of length; funicle with pale setae but no scales; club *c.* × 0·3 as long as pronotum. Upper surface of prothorax usually strongly and uniformly granulate; disc sometimes depressed and with traces of a narrow median carina. Surface of elytra usually shagreened or microreticulate, matt. Scales, in part, green (sometimes glittering) but body often with extensive areas of whitish and/or brownish scales; mesepisterna covered with scales; tibiae with scales scattered or at most subcontiguous, even on outer (dorsal) aspect; segment 2 of hind tarsi sometimes with a few small scales. Setae throughout very fine and stiff. Females larger than males and apparently less numerous. Ventrite 5 simple in ♀, very weakly foveate in ♂. Median lobe of aedeagus simple, × 3 as long as broad and × 0·5–0·7 as long as pronotum, apex acuminate; struts × 2·2–2·7 as long as median lobe; manubrium slightly shorter than median lobe; flagellum very long, × 3·5–5·1 as long as pronotum. Spermatheca compact, tail usually smaller than body, tapering; gland-lobe obsolete; gland claviform or pedunculate; duct-lobe small; styli of ovipositor × 4·0–5·5 as long as broad.

Though of uncertain affinities within *Apirocalus*, the slender form, green scales, fine erect setae and, in some cases, the pronotal carina, long scape and long second tarsal segment of this group all show an affinity with the genus *Hellerrhinus*. All three species are new and occur in the Finisterre–Saruwaged Ranges.

Apirocalus (Apirocalus) nivosus sp. n.

(Figs 7, 147, 153, 234; Map 4)

Range. Huon Peninsula. Altitude: 750–2550 m.

Length, ♂: 7·4–8·7 mm; ♀: 9·3 mm. Black; antennal funicle, trochanters, femora and tibiae dark red; scales generally imbricate, green or brownish with extensive ill-defined pale areas on pronotum and elytra (notably on disc and declivity); head and rostrum usually with mainly pearly scales which contrast sharply with greenish scales of prothorax. *Head* with frons gently declivous, sometimes with traces of a short median carina; surface rugulose, with larger rugae at sides, encircling eyes; eyes larger and more strongly convex than in *A. ebrius*; scales imbricate, either all pearly or with ill-defined admedian patches of dull green; large ovate pearly scales extending on to head capsule behind and below eyes. *Rostrum* tapering evenly from base, widening again at genae; upper surface flat or depressed, sides sinuous, with a well defined smooth median carina, at least in anterior half; sides of pterygia and upper surface with large imbricate scales, usually pearly but partly green when those on frons are green. *Antennae* with funicle segments 4–7 subequal and distinctly longer than broad, 3 slightly longer, 1 and 2 almost twice as long and about twice as long as broad; club × 2·3–2·7 as long as broad; scape widening and thickening ±

evenly in distal two-thirds; upper surface with longitudinal rugulae which are mostly covered with scales; setae resembling those on funicle, fine, stiff, weakly curved, usually suberect on leading edge, semi-erect (and equally numerous) on upper surface, less strongly raised elsewhere, those on underside white, remainder mostly brown. *Prothorax* as long as broad in ♀, slightly longer than broad in ♂, widest in, or slightly in front of, middle, evenly tapering or weakly rounded basad, strongly rounded apicad; dorsal surface strongly convex in anterior half, its outline in profile view closely resembling that of sides in dorsal view, disc without any depression or median carina; dorsal surface and much of sides with well separated, well defined, shiny bead-like setiferous granules which project through a solid incrustation of imbricate scales, mostly greenish but often with very ill-defined paler areas above sides; surface between granules shagreened; setae similar to those on scape but smaller. *Elytra* narrowly ovate, × 1·3–1·4 as long as broad, sides weakly rounded; disc weakly to strongly depressed in ♂, weakly transversely convex in ♀; strial punctures obscured by scales; strial granules very small along stria 1 (about as large as surrounding scales), becoming larger in striae 2 and 3 and much larger in 4–6 (each granule with a minute pale seta arising from posterior aspect); interstrial granules smaller and fewer but each bearing a large, dark, fine, stiff, erect or suberect seta; elytral processes of ♂ elongate, terete, isodiametric or weakly compressed, rising steeply from posterior third of elytra and not, or weakly, diverging (spread only about two-thirds greatest width of elytra proper), without edges but with usual fringe of long setae at apex; processes of ♀ more strongly compressed, tapering and diverging than those of ♂; EPI 140–148 (♂), 130 (♀); scales as on prothorax, pale on disc (and anterior aspect of processes), declivity and costal margin; setae suberect, almost straight, the longest longer than those on scape. *Mesepisterna* covered with scales similar to those on elytra and with a few very small inconspicuous setae; arms of mesosternum ± covered with large and small scales and without any setae; mesepimera ± covered with small scales. *Metasternum* and venter with ± contiguous thin bluish white scales, those on metasternum and ventrite 1 as large as those on elytra (becoming greenish at sides), on ventrite 2 somewhat smaller, on ventrites 3–5 much smaller and separate; setae semi-erect, very fine, soft and mostly pale. *Legs* with femora moderately swollen; fore and middle tibiae very weakly incurved towards apex, hind tibiae straight; hind tarsal claw-segment × 1·9–2·1 as long as segment 3; scales greenish white or pearly with coppery reflexion, usually smaller than those on elytra, subcontiguous throughout femora and along outer (dorsal) edge of tibiae; setae very fine, mostly semi-erect, pale brown or whitish.

Genitalia. Median lobe of aedeagus (Fig. 147) two-thirds as long as pronotum and about three times as long as broad; struts × 2·2–2·4 as long as median lobe, flagellum × 7·5–7·7 as long and × 4·8–5·1 as long as pronotum (three observations), basal part curled into a ring. Spermatheca (Fig. 153) described above (p. 226).

Holotype ♂, Papua New Guinea: Morobe District, Huon Peninsula, Kalalo, 750 m, 20–30.viii.1966 (*G. A. Samuelson & Mena*), in BPBM.

Paratypes. Papua New Guinea: 2 ♂, 1 ♀, same data as holotype (2 BPBM, 1 BMNH); 2 ♂, east end of Saruwaged Range, 20 km SSW. of Kabwum, 2550 m, 5–12.viii.1966 (*G. A. Samuelson*) (BPBM, BMNH); 1 ♂, Eastern Highlands, Mt Piora, 6° 45′ S, 146° E, 2100 m, 12.vi.1966 (*J. L. Gressitt*) (BPBM).

Specimens examined: 7; dissected: 4 (3 ♂, 1 ♀).

The distinctive elytral processes of this species (Fig. 234) somewhat resemble those of *A. (Molobrium) gracilis* but the seta-fringes at their apex show clearly its affinity with the nominate subgenus. The extensive pale areas on the elytra give this species a pruinose or frosted appearance. The record for Mt Piora is unexpected and requires confirmation.

Apirocalus (Apirocalus) atrigenua **sp. n.**

(Figs 148, 152, 235, 236; Map 4)

Range. Madang District (Finisterre Range). Altitude: 2550 m.

Length, ♂: 8·2–9·2 mm; ♀: 9·9 mm. Head, body, antennal scape, coxae and tarsi black; antennal funicle reddish black; trochanters dark red; femora dark red with darker, usually black, knees; tibiae dark red, becoming blackish near apex; scales generally tessellate, green and/or brown, paler on elytral declivity (elytra sometimes with pale mottling). *Head* and *rostrum* as in *A. nivosus*, except median rostral carina finer (indistinct in ♀) and scales contrasting less strongly in colour with those of body. *Antennae* as in *A. nivosus*. Prothorax about as long as broad in ♂, slightly broader than long in ♀, widest in middle, sides moderately and fairly evenly rounded; disc of pronotum flattened or weakly depressed, often with

traces of a narrow median carina, anterior third only weakly convex in profile view; otherwise as in *A. nivosus*. *Elytra* ovate, × 1·2 as long as broad in ♂, × 1·15 as long in ♀, sides moderately and evenly rounded in ♂, rather strongly rounded in ♀; disc flat in profile view, flat or weakly convex transversely; surface slightly uneven; strial punctures concealed by scales; strial granules prominent, mostly larger than surrounding scales and increasing in size towards sides but not as much, or as abruptly, as in *A. nivosus*; scales mostly tessellate or weakly imbricate; setae similar to those on scape. ***Sternum*** as in *A. nivosus*. *Sexual dimorphism* strong; antennal scape more slender in ♀; setae on scape, elytra and legs more nearly erect in ♀ and those on elytra larger; setae on femora of ♂ usually subrecumbent; fore and middle tibiae of ♂ distinctly incurved towards apex, those of ♀ almost straight; apical third of fore tibia of ♂ compressed, bluntly carinate dorsally (evenly rounded in ♀); elytral processes of ♂ similar to those of *A. nivosus* but longer, less strongly tapering and distinctly diverging, often weakly curving dorsolaterad, apex with fringe of long soft mostly pale setae; sides of elytra strongly narrowed at process bases, so that, although they diverge, their spread is distinctly less than greatest width of elytra proper (Fig.235); elytral processes of ♀ very short but acute, cone-shaped, diverging, their spread distinctly less than greatest width of elytra proper (Fig. 236); they are covered with dense dark stiff erect setae and surmounted by a short fringe of slightly longer, soft pale setae; EPI 139–145 (♂), 109 (♀).

Genitalia. Median lobe of aedeagus (Fig. 148) × 0·6 as long as pronotum and about × 3 as long as broad; struts × 2·5 as long as median lobe; flagellum × 6·8 as long and × 3·8 as long as pronotum (two observations). Spermatheca (Fig. 152) with tail about as large as body.

Holotype ♂, Papua New Guinea: Madang District, Finisterre Range [Upper Nankina], Teptep, 8500 ft [2550 m], vii.1975 (*R. W. Hornabrook*), in BMNH.

Paratypes. 4 ♂, 1 ♀, same data as holotype (3 RWH, 2 BMNH).

Specimens examined: 6; dissected: 3 (2 ♂, 1 ♀).

This species differs from the other two members of the group in its duller, brownish colour and its strong sexual dimorphism.

The name ('black-knees') is a noun in apposition.

Apirocalus (Apirocalus) bacchusi sp. n.

(Figs 8, 77, 149–151; Map 4)

Range. Madang District (Finisterre Range). Altitude: 2700 m.

Length, ♂: 9·0 mm; ♀: 10·5 mm. Black, legs dark red (coxae and tarsi black); scales pale green (many glittering), paler still on declivity (pearly on head and sternum). *Head* and *rostrum* as in *A. nivosus* except eyes smaller, frons without traces of a median carina and median rostral carina variable (sometimes absent). *Antennae* with funicle and club as in *A. nivosus*; scape strongly flattened, ± parallel-sided beyond basal third, apex simple; upper surface rugulose or not, covered with ovate subcontiguous scales; setae on leading edge distinctly shorter than those on funicle and more strongly curved, brown or hyaline, only about half as long as greatest diameter of scape. *Prothorax* slightly longer than broad in both sexes, widest in or behind middle; sides moderately and fairly evenly rounded; disc broadly flattened or weakly depressed, with traces of a narrow median carina; upper surface variably granulate – in ♀ granules few, small and confined to discal depression, in ♂ numerous, of various sizes and covering entire upper surface and upper part of sides; setae small and inconspicuous. *Elytra* ovate, × 1·25 as long as broad, disc weakly convex or almost flat, surface slightly uneven but without distinct transverse folds; strial punctures very small, completely obscured by scales; strial granules small (× 1–2 diameter of surrounding scales), not increasing in size towards sides; interstrial granules smaller still, their setae small and inconspicuous in ♂, larger in ♀ (those on interstriae 6 and 7 larger than those on scape), always dark brown; elytral processes of ♂ elongate, tapering, somewhat flattened and with distinct edge on outer side but still very thick to near apex, weakly rising or curving upwards and only moderately diverging so that spread about equals greatest width of elytra proper; processes of ♀ shorter, more strongly tapering and scarcely rising at all; EPI 148–150 (♂), 140 (♀); scales contiguous or imbricate throughout except for dark zone on mesodorsal aspect of processes where only small separate brown scales occur. *Sternum* as in *A. nivosus* but ventrite 1 with wider scale-free border behind hind coxae. *Legs* as in *A. nivosus* except setae throughout smaller and subrecumbent.

Genitalia. Median lobe of aedeagus (Figs 149, 150) half as long as pronotum and three times as long as broad; struts × 2·7 as long as median lobe; flagellum × 6·6 as long as median lobe and × 3·5 as long as pronotum (one observation). Spermatheca (Fig. 151) as in *A. nivosus*.

Holotype ♂, Papua New Guinea: Finisterre Range, Upper Naho Valley, S. side of Mt Abilala, *c.* 9000 ft [2700 m], Station No. 102, 19–22.xi.1964 (*M. E. Bacchus*), in BMNH.

Paratypes. 1 ♂, 1 ♀, same data as holotype (BMNH).

Both paratypes are severely abraded and the female is damaged.

Bacchus, in this instance, is a modern personal name (a variant of *Backhouse*) and the name of this species has been formed accordingly.

The *hydrographicus*-group

Elytra distinctly to very strongly convex on disc, both transversely and in profile view, often globose; processes variable, dimorphic or not. Pronotum flat or weakly convex in profile view, with a ± distinct (though totally undefined) depression in basal third; greater part of surface with separate, well defined shiny granules which are sometimes divided along mid-line. Antennal scape capitate or not, setae on leading edge usually (but not always) small and recumbent; club ×0·3 as long as pronotum. Rims of pterygia microreticulate in both sexes and ♀ without large setae on postero-ventral margin of prothorax. Scales in ♂ reduced or absent on dorsum but usually forming pale stripe at sides, at least on elytra; ♀ similar or with more uniform scaling; antennal funicle without any scales, tarsi usually without (sometimes a few on segments 1 and 2 of hind tarsi). Mesepisternum usually with scales, arms of mesosternum usually without. Median lobe of aedeagus ×2·1–2·7 as long as broad and ×0·4–0·5 as long as pronotum, weakly curved in profile view, sides ± parallel, widening before the very broadly rounded apex (Figs 154, etc.); struts ×2·8–3·9 as long as median lobe and ×1·4–1·7 as long as pronotum; manubrium distinctly longer than median lobe; flagellum short or very short. Spermatheca variable; styli of ovipositor ×3·2 as long as broad (one observation).

A well defined group of species with an easterly range, mostly occurring at fairly low altitude. The reduced flagellum of *A. vexillarius* is seen again in *A. cornutus* (*cornutus*-group) and the spermathecae of these two species are similar.

Apirocalus (Apirocalus) hydrographicus Marshall

(Figs 9, 154–157, 161, 162; Map 5)

Apirocalus hydrographicus Marshall, 1956 : 18, fig. 4. Holotype ♂, Papua New Guinea (BMNH) [examined].

Range. Northern District. Altitude: 300–1300 m.

Length 7·8–10·5 mm. Black, with femora, tibiae and antennal funicle usually reddish black but entirely red-brown (immature) specimens frequent; scales in ♀ usually dense, mainly pale brown or greenish white, in ♂ white or greenish white and sparser, sometimes confined to lateral and declivital patches on elytra and sides of prothorax and metasternum. *Head* with frons very weakly declivous (often almost in line with rostrum in profile view), weakly but fairly regularly rugose, rugae at sides extending obliquely across temples; eyes moderately convex (about as in *A. cornutus*); scales densest above eyes, smaller and sparser elsewhere, not, or only partly concealing frontal rugae. *Rostrum* with sides parallel from base, widening at genae; upper surface transversely convex, sides weakly and gradually narrowed behind antennal insertions; apex evenly rounded in profile view, oblique; median rostral carina broad, distinctly raised, smooth, glossy, extending from base to level of antennal insertions or even beyond, flanked by sulci containing one or more cariniform rugae; scales confined to posterior part of dorsal surface and extending over ill-defined margins on to sides but few, if any, scales on outer surface of pterygia; setae on posterior part of dorsal surface white, truncate and recumbent. *Antennae* with funicle segments 1 and 2 subequal and ×2·1–2·6 as long as broad, 3 ×0·6–0·7 as long as 2, 4–7 subequal, slightly shorter than 3 and ×1·1–1·4 as long as broad; club ovate, ×2·3–2·8 as long as broad; scape weakly and smoothly sinuous, weakly flattened, widening and thickening throughout from base, more strongly so near apex, forming a distinct head but without any abrupt constriction between it and shaft; upper surface fairly even, punctures simple or with raised lips which project through the often dense scales; setae on scape usually distinctly shorter than those on funicle, strongly curved, evenly distributed, recumbent or subrecumbent throughout. *Prothorax* as long as broad in ♀, slightly longer than broad in ♂, widest in, or a little in front of middle, thence moderately rounded apicad, evenly tapering basad, sometimes with a weak pre-apical constriction; greater part of dorsal surface strongly and evenly granulate, granules

separate, often divided along at least part of mid-line, diameter of largest equal to one-half to two-thirds that of funicle; scales dense on dorsal surface (between granules), sparser but larger on sides which are strongly rugose, larger still, paler and in part imbricate above coxae; setae throughout very small and inconspicuous. *Elytra* globose in ♂, subglobose in ♀, $\times 1{\cdot}0$–$1{\cdot}2$ as long as broad; striae marked by deep punctures; strial granules about as large as punctures (but often indistinct); interstrial granules smaller and fewer than strial granules (often mostly absent) but their setae much larger (still only $\times 1$–3 diameter of surrounding scales, so relatively small and inconspicuous); scales differing between sexes (see below). *Mesepisterna* with numerous, mostly large, scales and strong punctures of various sizes, containing linear appressed or recumbent setae which are whitish and conspicuous; arms of mesosternum without, or with fewer, smaller, scales, fewer setae and no strong punctures. *Metasternum* and ventrites 1 and 2 generally with dense scales and fine pale setae which arise from small granules; ventrites 3–5 with much smaller, sparser scales and smaller denser setae, of various sizes. *Legs* with femora moderately to rather strongly swollen, ± straight, hind femora distinctly compressed and often with a distinct edge dorsally (compared with middle femora); fore tibiae weakly incurved towards apex, middle tibiae weakly incurved throughout, hind tibiae ± straight; scales variable, smaller, on average, than those on elytra but concolorous with them, largest and densest on widest part of femur but not imbricate; setae linear, pale greenish or brownish, iridescent, mostly recumbent or weakly raised on femora, those on knees arising from small granules; setae on outer (dorsal) edge of tibiae small, strongly curved, mostly blunt, those on inner edge about twice as long, almost straight and finely pointed, often dark brown towards tibial apex; tarsi with hyaline or brownish setae, usually darker peripherally, thus forming a conspicuous fringe on segment 3 against pale background of projecting setae of ventral pads. *Sexual dimorphism* well marked; elytral processes small and well separated; those of ♂ arising from cone-shaped base, terete and subisodiametric in middle, curving upwards and inwards and becoming horizontally explanate towards apex, which bears a radiating fringe of long blackish or golden brown setae; processes of ♀ usually much shorter, strongly tapering, ± pointed and with reduced fringe but if elongate, weakly tapering, truncate and with long fringe, then straight and with planes of compression strongly tilted inwards; spread of processes in ♀ ± equal to greatest width of elytra proper, distinctly exceeding this in ♂; base of elytra distinctly raised (weakly keeled) in ♂, not, or indistinctly, raised in ♀; EPI 131–145 (♂), 114–131 (♀). Scales on elytra in ♀ usually dense and fairly uniform, paler and imbricate in shoulder region and across top of declivity (sometimes extending along processes); in ♂, area between suture and stria 6 with mostly small, separate scales, either pale or brown and inconspicuous, often with small clusters of larger pale scales; beyond stria 6 scales much larger and denser, either throughout or in patches but always present (and imbricate) in shoulder region (basal part of interstria 7); declivity with an isolated white blotch consisting of large imbricate scales (sometimes extending narrowly along processes). Disc of venter of ♂ very broadly and distinctly depressed, ventrite 5 broadly rounded at apex and distinctly foveate; disc of venter of ♀ not, or weakly, depressed, ventrite 5 ogival, indistinctly foveate but with apex deflexed ventrad.

Genitalia. Median lobe of aedeagus (Figs 154–157) $\times 0{\cdot}4$ as long as pronotum and $\times 2{\cdot}1$–$2{\cdot}3$ as long as broad; struts $\times 3{\cdot}3$–$3{\cdot}8$ as long as median lobe; flagellum $\times 2{\cdot}0$–$2{\cdot}3$ as long as median lobe and $\times 0{\cdot}8$–$1{\cdot}0$ as long as pronotum. Spermatheca (Figs 161, 162) with tail slightly smaller than body, tapering; gland-lobe distinct, its axis making a small (rarely large) angle with that of body; duct-lobe large, as broad as gland-lobe at base and curving 'dorsad' over the latter (five observations); gland large (about as long as body), slender; duct about twice overall length of spermatheca.

Holotype ♂, PAPUA NEW GUINEA: 'Hydrog^{r}. Mts. / 2500 ft. B.N.G.' (Janson MS) and 'Apirocalus hydrographicus Mshl. TYPE ♂' (Marshall MS), in BMNH.

Paratypes. 4 ♂, 3 ♀, same data as holotype (6 BMNH, 1 BPBM); 1 ♂, 1 ♀, 'Hydrographer Mts., / Brit. N.G., 2500 ft., / Feb. Mrch. 1918. / (Eichhorn Bros.),' (printed; apparently these data apply to all the Hydrographer specimens). One of the seven males listed by Marshall remains unaccounted for. 1 ♂, 1 ♀, Orrori [Kokoda, near The Gap], 3000 ft [900 m], vii.1933 (*L. E. Cheesman*); 1 ♂, Ishurava [Isurava], 3000 ft [900 m], vii.1933 (*L. E. Cheesman*) (all BMNH). All the above paratypes bear a Marshall MS label similar to that attached to the holotype but reading 'COTYPE ♂' (or ♀).

Other specimens. 27 ♂, 12 ♀, Mt Lamington, 1300–1500 ft [390–450 m] [pre-1930] (*C. T. McNamara*) (33 SAM, 4 BMNH, 2 AMNH); 1 ♀, Mt Lamington, 500 m, vi.1966 (*P. Shanahan*) (BPBM); 1 ♂, 1 ♀, Popondetta area, 8–10.iv.1966 (*R. Radzyner*) (DAPM); 1 ♂, Popondetta, 2–4.v.1970 (*J. Stibick*) (CWO'B); 4 ♂, 6 ♀, Managalase Plateau, xi.1972 (*R. W. Hornabrook*) (8 RWH, 2 BMNH); 1 ♂, Kokoda, 2000 ft [600 m], 3.xi.1957 (*J. Sedlacek*) (CWO'B); 1 ♀, Kokoda, 400 m, 14–16.xi.1965 (*J. Sedlacek*); 4 ♂, 2 ♀, Kokoda-Pitoki, 400 m, 23 and 24.iii.1956 (*J. L.

Gressitt) (all BPBM); 1 ♀, Kokoda, v.1956; 1 ♀, Kokoda, Isuava-Biage valley, 4200–4400 ft [1260–1320 m], 5.vi.1956; 1 ♂, Biage valley, 1200 ft [360 m], 26.vi.1957 (all *J. Healy*); 1 ♂, 1 ♀, Igora Pltn, 23.iii.1956; 2 ♀, Mamoo Pltn [300 m], 22.iii.1956 (all *Szent-Ivany*) (all DAPM); 1 ♀, Asela, 1.xi.1966 (*G. Baker*) (CWO'B); 1 ♂, Saiko [?=Saiho], 13–17.i.1958 (*J. Smart*) (BMNH).

Specimens examined: 82; dissected: 12 (7 ♂, 5 ♀).

Bionomic data. 'In rainforest' (Biage valley, JH); 'On *Coffea canephora*' (Igora Pltn, S-I); 'On young cacao trees' (Mamoo Pltn, S-I).

The Mt Lamington specimens, of both sexes, are more densely scaled than those from the other localities, some females from which are as bare-looking as the males, notably the paratype from Orrori (which is also the largest specimen).

Apirocalus (Apirocalus) orientalis **sp. n.**

(Fig. 158; Map 5)

Range. Eastern extremity of mainland, beyond 149° E. Altitude: 1020–1320 m.

Length 8·2–9·2 mm. Differs from *A. hydrographicus* as follows. Elytral declivity entirely pale in both sexes, pale area sharply defined dorsally but not forming a discrete blotch between process bases; setae on leading edge of scape almost as long as, and stouter than, those on funicle, usually stiff and semi-erect; scales on prothorax more nearly uniform in size; elytral interstrial granules larger, about as large as strial granules, uniseriate on disc but irregular (and more numerous) towards base; hind femora not distinctly compressed, fore and middle tibiae less strongly curved (almost straight in ♀), setae usually distinctly raised on femora and outer edge of tibiae and all pale on tarsi. *Sexual dimorphism* less well marked than in *A. hydrographicus*; elytral processes of ♂ usually straight, weakly tapering throughout (not widening apically), fringe setae mostly brown (some pearly white anteriorly); EPI 125–133 (♂), 113–115 (♀); elytra densely squamose in both sexes but scales larger (and hence more conspicuous) in ♀.

Genitalia as in *A. hydrographicus* except flagellum slightly longer, × 2·4–2·6 as long as median lobe and × 0·9–1·1 as long as pronotum.

Holotype ♂, Papua New Guinea: Milne Bay District, Mt Mura [Mt Baritun] (30 [k]m NW. of Mt Simpson), Boneno, 4000 ft [1200 m], ix.1940 (*F. Shaw Mayer*), in BMNH.

Paratypes. Papua New Guinea: 1 ♂, 1 ♀, same data as holotype (BMNH); 1 ♂, Milne Bay District, Agaun [shown as in Central District on Map 9202], 4400 ft [1320 m], viii.1969 (*R. Pullen*) (ANIC); 1 ♀, Central District, Amazon Bay, Komania, 3400 ft [1020 m], 11–26.xi.1962 (*W. W. Brandt*) (ANIC); 1 ♂, 1 ♀, Milne Bay, vii, (*Wind*) (MCZ).

Specimens examined: 7; dissected: 2 (1 ♂, 1 ♀). The genitalia of the holotype were removed without dissection.

The elytral processes of the male resemble those of some females of *A. hydrographicus*; normal females of these two species can only be separated by their different scapal setae.

Apirocalus (Apirocalus) ater **sp. n.**

(Figs 10, 163; Map 5)

Range. Goodenough I. Altitude: 1600 m.

♀. Length 11·8–12·0 mm. Black, femora and tibiae blackish red; scales dense, pale greenish or bluish grey but very small, imparting matt appearance to dorsum but no obvious colour, larger and denser around elytral apex but not forming a distinct pale zone or blotch. *Head* and *rostrum* as in *A. hydrographicus* but eyes relatively smaller, scales smaller and almost confined to frons. *Antennae* as in *A. hydrographicus* but funicle segments slightly more elongate (segment 4 < × 1·8 as long as broad); scape (Fig. 10) almost straight, ± parallel-sided in basal three-quarters, thickening progressively throughout (more strongly near apex), flattened, surface strongly sculptured, apex very weakly swollen anteriad; setae scarcely more than half as long as longest setae on funicle, fine, stiff, ± raised, pale brown or hyaline; scales ovate and lanceolate, mostly lying in grooves between rugae. *Prothorax* as long as broad, widest in front of middle, tapering thence to extremities; dorsal surface with basal depression weak or obsolete,

evenly covered with well defined bead-like granules (denser than in *A. hydrographicus*), divided in posterior half by smooth median line; scales abruptly ceasing at sides; setae very small and inconspicuous; sides of prothorax strongly rugose and almost scale-free. *Elytra* subglobose, × 1·2 as long as broad; strial punctures very small and indistinct; strial granules well defined or not; interstrial granules as large as, or larger than, strial granules, irregularly uniseriate on disc, more irregular towards base, often fusing with each other or with strial granules; scales condensed at extreme base of interstria 6 (forming a very small pale fleck) and around apex, sides almost bare; setae generally minute, becoming larger towards apex where largest resemble those on tibiae and are distinctly larger than those on scape; elytral processes short, strongly tapering, compressed, strongly diverging but their spread only slightly exceeding greatest width of elytra proper; fringe setae mostly pale, grading to brown posteriorly; EPI 127–129. *Mesepisterna* with well defined punctures containing minute pale setae; arms of mesosternum with a few much smaller punctures containing similar setae; no scales on either of these parts or on mesosternal process. *Metasternum* and ventrites 1 and 2 with scales towards sides only; ventrites 3–5 without scales; setae throughout small, whitish or greenish, stiff and semi-erect, similar to those on tibiae; ventrite 5 weakly foveate, apex broadly rounded and deflexed ventrad. *Legs* as in *A. orientalis* but setae and scales much smaller; much of femora without, or with very small, well separated scales.

Genitalia. Spermatheca (Fig. 163) similar to that of *A. hydrographicus*; duct much longer, more than eight times overall length of spermatheca (one observation).

Holotype ♀, Papua New Guinea: Milne Bay District, Goodenough I., E. slope, No. 9, 1600 m, 7–23.x.1953 (*G. M. Tate*), Fourth Archbold Exp., in AMNH.

Paratype ♀. Same data as holotype (BMNH).

The largest known species and possibly the most easterly (competes for this with *A. orientalis*). Clearly related to *A. hydrographicus* but with much smaller scales and setae throughout; indeed it lacks scales on the sides of the elytra where, in *A. hydrographicus*, they are largest and densest.

Apirocalus (Apirocalus) vexillarius Marshall

(Figs 11, 159, 160, 164, 165; Map 5)

Apirocalus vexillarius Marshall, 1956 : 19. Holotype ♀, Papua New Guinea (BMNH) [examined].

Range. Central District. Altitude: *c.* 2000 m.

Length 8·2–9·0 mm. Dark or blackish red, apex of rostrum, sides and processes of elytra black, tarsi usually only slightly darker than tibiae; scales mostly dark brown and inconspicuous but forming a prominent pale creamy white stripe along sides of prothorax and elytra. *Head*, *rostrum* and *antennae* as in *A. hydrographicus* except scape (Fig. 11) more slender, smoother, widening slightly towards apex but not capitate, setae very fine and small, distinctly shorter than those on funicle, mostly brown, strongly curved and recumbent; scales very small and dense but concolorous with cuticle, so inconspicuous. *Prothorax* as in *A. hydrographicus* except sides less strongly rugose and sides of dorsal surface with tract of large, pale, partly tessellate or weakly imbricate scales extending from hind margin but evanescing before reaching anterior margin. *Elytra* ovate, × 1·2–1·3 as long as broad; disc ± strongly and irregularly granulate, sometimes also rugose; setae generally minute, larger on declivity but often inconspicuous even there; scales mostly dark brown, as on prothorax but with a pale longitudinal tract similar to that on prothorax and continuous with it, extending along interstria 7 from base to process which it narrowly ascends along its outer (dorso-lateral) edge; similar scales form an ill-defined fascia across upper part of declivity just below middle of process bases and extend along inner (ventral) edge of processes. *Mesepisterna* with numerous small, ill-defined punctures containing small setae and numerous small, often mostly brown, scales; arms of mesosternum smooth (apart from microsculpture) and bare. *Metasternum* and venter as in *A. hydrographicus* except ventrites 3–5 scale-free. *Legs* with femora moderately swollen, hind pair not distinctly compressed; tibiae almost straight; femora and tibiae with dense dark brown or greenish scales which are much smaller than those on elytra; setae on femora mostly pale, linear, ± curved and mostly recumbent, stouter but scarcely longer than those on scape; setae on outer edge of tibiae similar but semi-erect. *Sexual dimorphism* slight; elytra in ♂ more elongate and less strongly convex in profile view than in ♀ (cf. *A. hydrographicus*); elytra of ♀ strongly and evenly tapering to narrowly rounded apex which is strongly deflexed ventrad, apex in ♂ ogival and only slightly deflexed; processes in both sexes elongate, compressed and having edges on both sides distally, plane of compression strongly tilted inwards (especially in ♂), fringe setae pitchy, grading to whitish anteriorly; processes of ♂ more elongate but otherwise similar to those of ♀, their spread not, or only slightly exceed-

ing greatest width of elytra proper; EPI 148 (♂), 128–138 (♀); ventrite 5 ± distinctly foveate in both sexes but apex in ♀ deflexed ventrad (in sympathy with elytral apex).

Genitalia. Median lobe of aedeagus (Figs 159, 160) similar to that of *A. hydrographicus* but less strongly widening towards apex, half as long as pronotum and ×2·6–2·7 as long as broad; struts ×2·8 as long as median lobe; flagellum very short, ×0·3 as long as median lobe and < ×0·2 as long as pronotum. Spermatheca (Figs 164, 165) plump, tail smaller than body; gland-lobe very short, its axis making a strong angle with that of body; duct-lobe small, duct about equal to overall length of spermatheca.

Holotype ♀, Papua New Guinea: 'OWGARRA / B. N. GUINEA / A. S. Meek' (printed), 'Apirocalus vexillarius Mshl. TYPE ♂' (Marshall MS), D. Sharp coll., in BMNH. Owgarra '. . . is somewhere behind Bereina but is not on maps. It is probably now non-existent' (J. N. L. Stibick, pers. comm.).

Paratype. 1 ♂, 'Brit New G' (MS), 'Nevinson Coll. / 1918–14' (printed), 'Apirocalus vexillarius Mshl. COTYPE ♂' (Marshall MS), in BMNH. Marshall attributes both specimens to Meek (*erratim* Meck) but I can see no justification for this.

Other specimens. 1 ♂, 1 ♀, Central District, Woitape, [*c.* 2000 m], 14–16.x.1963; 1 ♀, Goilala, Yemi village, 14.x.1963 (all *L. Smee*) (all DAPM).

Specimens examined: 5; dissected: 3 (2 ♂, 1 ♀).

Bionomic data. 'In native garden' (Woitape, LS).

Though clearly related to *A. hydrographicus*, this species differs from it in the similar appearance of the sexes and the fact that the female, not the male, is the more rotund sex.

Apirocalus (Apirocalus) inornatus sp. n.

(Map 5)

Range. Central District. Altitude: 700 m (?).

♀. Length 8·0–8·8 mm. Differs from *A. vexillarius* as follows. Scales throughout uniformly pale brown or pale green, without any trace of paler stripes composed of larger scales; elytral declivity slightly paler than disc but without a transverse fascia between processes; eyes distinctly more strongly convex; EPI 123–132.

Genitalia. Spermatheca similar to that of *A. vexillarius* (differences probably not significant); duct of similar length.

Holotype ♀, Papua New Guinea: Central District, Morokai [?=Moroka], R. Oberthür coll., in MNHN.

Paratype. 1 ♀, same data as holotype (BMNH).

The *cornutus*-group

Elytral processes variable, usually differing markedly between the sexes. Surfaces of pronotal and elytral discs even, granulate or not. Antennal club ×0·2–0·3 as long as pronotum; scape straight in distal three-quarters, flattened, parallel-sided or weakly and evenly widening distally, without any apical expansion or pre-apical constriction; setae on leading edge ± blunt, usually recumbent and distinctly shorter than greatest diameter of scape in middle of length (only slightly shorter in *A. c. tenuiscapus*). Rims of pterygia with transverse microsculpture (milled) in ♂, smooth in ♀ (but milled in both sexes of *A. paradoxus*); ♀ usually with fringe or cluster of very large stiff erect pale setae on postero-ventral margin of prothorax. Some tarsal and antennal funicle segments sometimes with dense scales. Median lobe of aedeagus simple, ×2·2–4·2 as long as broad, usually about half as long as pronotum (< ×0·86 as long in *A. paradoxus*); struts usually ×2·2–2·7 as long as median lobe (> ×1·47 in *A. paradoxus*) and ×1·1–1·6 as long as pronotum; flagellum variable – short and slender in *A. mus* (shorter than pronotum), in remaining species either very long (×2·3–4·3 as long as pronotum) or very short (×0·2 as long as pronotum) and, for its length, stout; internal sac lined with denticles of various types, some of which may be pigmented. Spermatheca with tail usually smaller than body, strongly reflexed; gland-lobe variable, always very large in species with short or very short duct (Fig. 82), usually smaller or obsolete in species with very long duct; gland claviform or pedunculate; duct-lobe about half as long as body, slender, tapering, straight or weakly sinuous; styli of ovipositor ×2·5–4·0 as long as broad.

This group may be recognized by the flattened but otherwise simple antennal scape with whitish or brown setae; these may be recumbent or semi-erect but are always ± blunt-tipped (*A. bacchusi* has a similar scape but with fine erect black setae on the leading edge). Females commonly have the elytral processes represented by obtuse angulations. This may be the ancestral condition in the group, since elongate processes, where they occur in females, exhibit great variety of form, as would be expected if they were secondarily and independently derived from angulations.

The species with a very long flagellum and spermathecal duct occur in the northern part of New Guinea, while those with a very short flagellum and spermathecal duct occur in the south. Both groups occur in the Central Highlands, where their ranges may overlap slightly.

The *cornutus*-group includes the only species of *Apirocalus* that occur down to sea level; two of these are widespread and of some economic importance. One of them, *A. ebrius*, originally described as a variety of *A. cornutus*, occurs throughout the northern part of New Guinea, from Oro Bay (near Popondetta) in the east to Maffin Bay and Noemfor I. in the west, in both the lowlands and in the hills. The various populations vary with altitude in a similar manner throughout the range, so that not only do all the lowland populations resemble each other but most upland populations (from a given altitude-range) are also similar, in spite of the fact that they are, in many cases, obviously isolated from each other. Possibly, a very careful study would enable these various upland populations to be distinguished but the value of such an exercise is questionable. The complexity of the problem is indicated in Fig. 22 (p. 244).

Apirocalus (Apirocalus) cornutus Pascoe

(Figs 12, 13, 16, 56–58, 61–63, 75, 82, 166–173, 176–181, 243, 244; Map 7)

Apirocalus cornutus Pascoe, 1881 : 590.

Range. Central Highlands, Gulf and Central Districts, Northern Queensland. Altitude: 1–1700 m.

Length 7·0–10·2 mm. Black or reddish black; parts of tarsi and sometimes femora, distinctly red or red-brown. *Head* with frons weakly declivous in mid-line, leaving a ± raised, horizontal, triangular area above each eye; surface impunctate and weakly rugose; eyes moderately and evenly convex (Fig. 16). *Rostrum* weakly widening apicad; upper surface flat, merging with epistomal area which makes an angle of about 30° with horizontal plane of rostrum; sides of upper surface weakly excised; median carina distinct, polished, extending from base to level of antennal insertions. *Antennae* with funicle segment 2 distinctly longer than 1 and about × 3 as long as broad, segment 3 × 0·6–0·8 as long as 2 and about twice as long as broad, segments 4–7 subequal, about × 0·7 as long as 3 and × 1·3–1·7 as long as broad; club ovate-acuminate, × 2·2–2·7 as long as broad. *Prothorax* at least as long as broad in ♂, sometimes slightly broader than long in ♀, widest in, or a little in front of, middle; sides moderately and fairly evenly rounded in ♂, often straighter and weakly tapering posteriad in ♀; almost entire surface punctate, punctures small and ill-defined on disc, becoming much larger at sides, with narrow interstices which form a hexagonal mesh pattern; disc, near mid-line, with an irregular cluster of 8–20 shiny bead-like granules, varying greatly in size in each specimen but, on average, larger and more prominent in ♀. *Elytra* short oblong-ovate, × 1·1 as long as broad in ♂, × 1·2 as long in ♀; sides moderately and evenly rounded; disc moderately and evenly convex, at least transversely; declivity very steep, not, or only weakly, raised along suture; strial granules ± distinct, interstriae without granules. *Mesepisterna* with imbricate scales and pale setae; arms of mesosternum with contiguous or imbricate scales and no setae. *Legs* stout, femora strongly swollen, especially in ♂; fore and middle tibiae of ♂ strongly incurved very near apex, less so in ♀. *Sexual dimorphism* well marked; elytral processes of ♂ flattened, blade-like, ± strongly tapering to a broadly rounded apex; outer margins with sharp edges, diverging continuously from bases to near apices, so that spread of processes distinctly exceeds greatest width of elytra proper; inner (posterior) margins blunt, evenly rounded (in section); planes of processes distinctly tilted inwards; processes of ♀ variable but usually much shorter and stouter than those of ♂.

Genitalia. Flagellum very short, at most only slightly exceeding greatest width of median lobe of aedeagus. Spermatheca plump, tail smaller than body, curved, tapering; gland-lobe prominent, its axis making a large angle with axis of body; gland slender, claviform; duct-lobe short, tapering, ± straight; duct about half overall length of spermatheca.

The very short flagellum and spermathecal duct distinguish this species unequivocally from all others, except *A. paradoxus* and *A. vexillarius*.

Apirocalus (Apirocalus) cornutus cornutus Pascoe

(Figs 12, 16, 56–58, 75, 82, 166–169, 176, 177, 243, 244; Map 7)

Apirocalus cornutus Pascoe, 1881 : 590; Fairmaire, 1881 : 290; Waterhouse, 1883 : pl. 129, fig. 9; Pascoe, 1885 : 209; Faust, 1892 : 189; 1899 : 13; Ballard, 1927 : 297, 298, *partim*; Marshall, 1956 : 18; Szent-Ivany, 1956 : 83, *partim*; Voss, 1958 : 209; Szent-Ivany, 1959 : 427–428, *partim*; 1961a : 145; Simon Thomas, 1962 : 11, etc.; Szent-Ivany, 1962 : 5; Szent-Ivany & Ardley, 1963 : 130; Smee, 1964 : 23, 24, fig. 4; 1965 : 100; Le Pelley, 1968 : 111, 441, *partim*; Szent-Ivany, 1972 : 561b, 562, fig. k; Gray & Wylie, 1974 : 73, *partim*; Lamb, 1974 : 108, 113, 116, fig. 27. Holotype ♂, PAPUA NEW GUINEA (BMNH) [examined].
Apirocatus cornutus Pascoe; Faust, 1897 : 232 [*lapsus*].
[*Apirocalus gestroi* Pascoe; Voss, 1958 : 209. Misidentification.]

Range. Gulf and Central Districts, Darnley I., Murray I., Cape York. Altitude: 1–600 m.

Length 7·0–9·8 mm. Scales usually pale pearly grey throughout (when clean) and very dense or imbricate; setae mostly white, flattened, truncate and recumbent. *Head* between and below eyes with imbricate, compacted scales which become smaller, separate and metallic on vertex; rostro-frontal furrow deep and wide (except in mid-line) but true size concealed by overhanging scales; scales and setae on upper surface of rostrum similar to those on frons; genae and pterygia with looser scales and larger setae. *Antennae* with funicle segments 4–7 about × 1·3 as long as broad; club × 2·2–2·5 as long as broad, × 1·2–1·6 as wide as funicle and × 0·7–0·9 as long as segments 5–7 together; segments 2–4 usually extensively covered with round scales, segments 1, 5, 6 and (rarely) 7 with round or lanceolate scales, or both; setae on segments 2 and 3 pale, flattened, truncate and recumbent, grading apicad to dark, semi-erect, finely pointed bristles on segment 7; scape (Fig. 12) straight or very weakly sinuous, parallel-sided, thickening evenly in distal half, surface with fine punctures and some rugae but both almost entirely concealed by scales; setae on leading edge pale, strongly curved and recumbent, longest about half as long as greatest diameter of scape in middle of length; those on upper surface similar but brown. *Prothorax* slightly broader than long in ♀; scales imbricate at sides, thus concealing punctures; setae pale, truncate and recumbent at sides, becoming smaller, narrower and browner on disc. *Elytra* with disc evenly convex in profile view; strial punctures largely obscured by scales; strial granules on disc usually smaller than surrounding scales and each bearing a pale, lanceolate, recumbent seta; interstriae each with a single row of similar but larger, often brown, setae; scales contiguous or weakly imbricate on disc, more strongly imbricate on sides and declivity; postero-dorsal aspect of processes with smaller, separate, brown scales which sometimes join up across suture to form a narrow dark transverse band; antero-dorsal aspect of processes often with larger, brighter scales, especially in ♂; setae in process fringes pale anteriorly, grading rather abruptly to red-brown or pitchy posteriorly. *Metasternum* and ventrites 1 and 2 with large loose dense scales (imbricate towards sides) and subrecumbent linear setae (broader towards sides); ventrites 3 and 4 with smaller scales and setae, both usually interrupted in mid-line; ventrite 5 with scales similar and/or smaller still and a variety of setae: some flattened, semi-erect, as on preceding ventrites; some very small, linear, forming a sparse pubescence; some long, finely pointed, fringing ventrite apex. *Legs* with scales similar to those on body, largely imbricate and compacted; fore coxae with small scales among the setae on anterior and mesal aspects; setae on femora pale, truncate and recumbent; tarsal segments 1 and 2 with a loose incrustation of large imbricate scales; segments 3 and 5 of fore and middle tarsi with, at most, a few much smaller ovate or lanceolate scales among the dense recumbent setae; segments 3 and 5 of hind tarsi, however, usually with more and larger scales (though smaller than those on segments 1 and 2). *Sexual dimorphism* usually well marked but ♀ sometimes with raised crests which project strongly posteriad (Fig. 58); processes of ♂ with inner margins always curved, conjointly describing a wide, ± even curve in antero-dorsal view; EPI 122–140 (♂), 106–128 (♀); setae on postero-ventral margin of prothorax of ♀ variable, often only as long as segment 3 of antennal funicle and scarcely visible from above; ventrite 5 of ♂ with two prominent but ill-defined longitudinal carinae which diverge weakly posteriad; ♀ with weaker carinae and apex of ventrite deflexed ventrad.

Genitalia. Median lobe of aedeagus (Figs 166–168) about half as long as pronotum and × 2·2–2·5 as long as broad; struts × 2·5–2·7 as long as median lobe and × 1·3–1·5 as long as pronotum; flagellum distinctly shorter than greatest width of median lobe, × 0·2 as long as pronotum; intermediate section of internal sac with double row of pigmented denticles. Spermatheca (Figs 176, 177) with gland-lobe prominent, dome-shaped or slightly elongate.

Holotype ♂, [PAPUA NEW GUINEA: Central District,] 'Yule Island' (Pascoe MS, on oval blue-surfaced disc) [pre-1877 (*James*)]; 'Apirocalus cornutus Pasc. type' (Pascoe MS), in BMNH. Apparently unique (see below).

Distribution. (Localities listed, as far as possible, from west to east.) PAPUA NEW GUINEA: Gulf District, Kikori; G.D., Ihu, Orokolo; G.D., Maura and Vaiviri Pltn; G.D., Kerema; G.D., Murua River; G.D., Murua Agric. Sta.; G.D., Iriri; G.D., Cupola Est.; G.D., Epo Est.; Central District, Mekeo, Aipeama; C.D., Beipa'a; C.D., Bereina, Epo Agric. Exp. Sta.; C.D., St Joseph's [Angabunga] River; C.D., Yule I.; C.D., Doa Est.; C.D., Aroa Est.; C.D., Rorona; C.D., Lolorua Pltn; C.D., Redscar Bay; C.D., Redscar [Vari Vari] Is; C.D., Koitakinumu; C.D., Laloki; C.D., Catalina Est.; C.D., Brown River; C.D., Vanapa River; C.D., Goldie River; C.D., Hombron Bluff; C.D., Port Moresby; C.D., Bomana; C.D., 14-mile Farm; C.D., Owers Corner; C.D., Rouna; C.D., Rouna, Riverside Inn; C.D., Astrolabe Range, Variarata; C.D., Bisianumu; C.D., Bisianumu Exp. Sta.; C.D., Sogeri; C.D., Moroka; C.D., Red Shield Farm; C.D., Kanosia Est.; C.D., Moare Pltn; C.D., Ninda Est.; C.D., Eriama Est.; C.D., Imita Ridge; C.D., Subitana; C.D., Subitana Pltn; C.D., Musgrave River; C.D., Javerere Pltn; C.D., Koitaki; C.D., Koitaki Est.; C.D., Daradai; C.D., Daradai Pltn; C.D., Kapakapa; C.D., Rigo; C.D., Rigo, Dorom; C.D., Kapagere. AUSTRALIA: Queensland, Darnley I.; Q., Murray I.; Q., Cape York, Blue Mts.

Specimens examined: 759; dissected: 27 (14 ♂, 13 ♀).

Additional (published) records. Haveri, Dilo, Hughibagu, Paumomu River, 1890–93 (*L. Loria*) (Faust, 1899 : 13).

Doubtful records. Chief among these is a series of 11 specimens labelled as taken on cacao and sweet potato at Mamoo Pltn on 11.ix.1957 by Szent-Ivany. This locality is in Northern District, near Popondetta, on the opposite side of the Owen Stanley Range from the established range of the species. This record is, however, supported by two specimens labelled as taken at Sangara, also near Popondetta, on 19.iii.1956 by E. S. Brown and another allegedly taken at Kokoda, 3.xi.1957, by J. Sedlacek. Dr Szent-Ivany (pers. comm.) considers it likely that *A. cornutus* has been introduced into Northern District, possibly by aircraft operating between Port Moresby and Kokoda or Popondetta. Records for Daulo Pass (x.1957, J. Sedlacek) and Ternate are almost certainly false. A specimen labelled 'King's Sound, N. W. Aust.' would be an interesting record, if confirmed. This, and other specimens labelled 'N. W. Australia', appear to belong to the Gulf District form of the species (see below).

The earliest record known to me is a pair of specimens from a small collection of insects, presented to the British Museum by John MacGillivray in January, 1851 which had been collected on the voyage of H.M.S. *Rattlesnake*. One of the specimens bears a label, 'Redscar Isles, S. coast of N. Guinea'. There can be little doubt that this refers to the Pariwara Is, off Redscar Head, described in some detail by MacGillivray in his account of the voyage (1852 : 290) and which are shown on recent maps as the Vari Vari Is. McGillivray records having visited the largest of the islands with a survey party on September 21st, 1849.

Bionomic data. *A. c. cornutus* has been found in rainforest (both primary and secondary) and in pasture; it has been observed on some 40 plant species, at least 12 of which were being damaged, namely coffee, cacao, rubber, rice, cassava, avocado pear, asparagus, coconut, kenaf (*Hibiscus cannabinus* Linnaeus), *Amaranthus tricolor* Linnaeus, balsam and rose.

Local variation. All the specimens from Gulf District and a small adjoining part of Central District (Aipeama) show a marked reduction in size and extent of the scales on the antennal funicle; these are often confined to segments 2 and 3 and even there they are largely replaced by recumbent hairs. The scales on segments 3 and 5 of the hind tarsi are similarly reduced or absent and the scales on the femora are sometimes small, separate and metallic. A similar reduction in funicle and tarsal scales occurs in populations at the other end of the range, in the Musgrave river valley and some adjacent localities, though the southernmost specimens, from Kapakapa and Kapagere, have normal scales. In the area around the Brown River, including Redscar Bay, the elytral processes of some females take the form of raised longitudinal crests which project posteriad beyond the elytral apex, so that the specimen resembles the male of a different species. Similarly, the processes of some males from this area are broader and swept back at a narrower angle to each other than usual. A complete series of intermediates has been observed between these and normal specimens in the Brown River population. Females from Yule I., the type-locality, often have broadly rounded elytral processes, weakly projecting posteriad but not raised

to form crests. The processes of Yule I. males also tend to be intermediate in shape between those of the Brown River form and the other mainland populations. The Torres Strait and Cape York specimens agree with those from the Port Moresby area except that they are of smaller average size and all have distinctly more strongly convex eyes (probably not, however, exceeding the limit of convexity to be found in some mainland populations).

A. cornutus was the first species of *Apirocalus* to be collected (see above) and the first to be described. Many other species have hitherto been confused with it and this has made the identification of references difficult. When in doubt about a reference, e.g. if no distribution is given, I have included it here.

The source of Pascoe's Yule I. specimens is uncertain. It is highly likely that the holotype came from a collection made by Dr James, parts of which were obtained by both the British Museum and A. Fry from Mr Higgins in 1876. Pascoe's collection also contains a set of this material, so it is reasonable to assume that his specimens are from the same lot. It also seems evident that he described *A. cornutus* before seeing the D'Albertis material (although Fairmaire reported on a D'Albertis specimen later the same year). This view is supported by the fact that the description appears to be based on a single specimen. It certainly refers to the male sex only and only the holotype among Pascoe's specimens fits the single length dimension given (5 lines). This is assuming that the rostrum is included; if it is not, then the dimension lies outside the observed range for the species. The holotype, rostrum included, measures 10·4 mm; 5 lines on the English scale = 10·6 mm. Fairmaire (1881 : 290) gives the length as 12 mm which is near 5 lines on the French scale (11·25 mm) (von Hayek, 1973 : 11). Fairmaire also draws attention to the incorrect type-locality (Fiji). Pascoe was prone to this particular kind of error; in his revision of *Catasarcus* (1870) he gives incorrect type-localities on three separate occasions.

Apirocalus c. cornutus may be distinguished from the other subspecies by its smaller, often reddish, antennal club and by the fact that it usually, perhaps always, has scales on the fore coxae. Throughout the greater part of its range it may be recognized by the large dense scales on antennal funicle segments 2–4(–6).

Apirocalus (Apirocalus) cornutus tenuiscapus subsp. n.

(Figs 13, 170, 171, 178–180; Map 7)

Range. Central District (Goilala Subdistrict). Altitude: 600–2550 m.

Length 7·1–10·2 mm. Differs from the nominate subspecies as follows. Setae on head and body narrower, those on elytra often semi-erect; antennae with funicle segments 4–7 slightly more elongate, × 1·4–1·7 as long as broad, club slightly larger but, on average, more elongate, × 2·4–2·7 as long as broad, × 1·6–1·9 as wide as funicle and × 0·9 as long as segments 5–7 together; funicle segments never with dense scales, segments (1), 2 and 3 with rather dense recumbent silky hairs and usually a few very small ovate scales, other segments with finer hairs and no scales; setae on proximal funicle segments less strongly raised and only slightly stouter than those on distal segments; scape (Fig. 13) more slender, very gradually and evenly widening from near base, setae less strongly curved, in length usually distinctly exceeding half greatest diameter of scape in middle of length; prothorax slightly more elongate (as long as broad in ♀); disc of elytra of ♂ less convex in profile view; fore coxae seldom with any scales, segments 1 and 2 of fore and middle tarsi with fewer, smaller, scales and segments 3 and 5 of hind tarsi usually without scales; hind tarsal claw-segment usually longer, × 2·0–2·3 as long as segment 3; elytral processes of ♀ rounded, obtuse, not projecting posteriad and never forming raised crests; EPI 125–135 (♂), 107–117 (♀); setae on postero-ventral margin of prothorax usually much longer than funicle segment 3 and clearly visible from above.

Genitalia. Median lobe of aedeagus (Figs 170, 171) more slender than in *A. c. cornutus*, × 2·4–2·7 as long as broad; struts shorter, × 2·2–2·5 as long as median lobe and × 1·1–1·3 as long as pronotum; flagellum about equal in length to greatest width of median lobe. Spermatheca (Figs 178–180) variable.

Holotype ♂, PAPUA NEW GUINEA: Central District, Mafulu, 4000 ft [1200 m], i.1934 (*L. E. Cheesman*), in BMNH.

Paratypes. PAPUA NEW GUINEA: 17 ♂, 11 ♀, same data as holotype (26 BMNH, 2 BPBM); 1 ♂, 1 ♀, Mondo, 5000 ft [1500 m], i–ii.1934; 1 ♂, 1 ♀, Mt Tafa, 8500 ft [2550 m], ii.1934;

3 ♂, 1 ♀, Diene, 2000 ft [600 m], xi.1933 (all *L. E. Cheesman*) (all BMNH); 4 ♂, 4 ♀, Tapini, *c*. 3200 ft [960 m], 12 and 15.vi.1960; 1 ♂, Tapini, in Govt coffee block, 11.vi.1960; 5 ♂, 2 ♀, Metsialavava Pltn, 5000 ft [1500 m], 16.vi.1962; 1 ♂, 2 ♀, near Tatupiti, *c*. 4000 ft [1200 m], 11.vi.1960; 1 ♂, Iemi No. 1 village, *c*. 6000 ft [1800 m], 20.viii.1963 (all *Szent-Ivany*); 1 ♂, Perumeva, 12 miles [19 km] N. of Tapini, *c*. 4500 ft [1350 m], 14.vi.1962; 1 ♀, Lipuava, *c*. 5000 ft [1500 m], 14.vi.1962; 3 ♂, 3 ♀, Bapiti, Kovatapa hamlet, NE. of Tapini, *c*. 3000 ft [900 m], 13.vi.1963 (all *Szent-Ivany et al.*) (all DAPM); 23 ♂, 17 ♀, Tapini, 975, 1000 and 1100 m, 1957, 1961 and 1968 (*Brandt*, *Gressitts*, *Mena*) (38 BPBM, 2 BMNH); 7 ♂, St Joseph [Alabule] River, Madew, 2000–3000 ft [600–900 m] [pre-1909] (*W. Stalker*) (BMNH); 10 ♂, 6 ♀, Tororo [14 km NE. of Tapini], 1560 m, 15–24.ii.1958; 4 ♂, 4 ♀, Bome [10 km N. of Tapini], iii and iv.1958 (all *W. W. Brandt*) (all BPBM); 29 ♂, 18 ♀, Loloipa [11 km NW. of Tapini], 25.xi–31.xii.1957; 67 ♂, 43 ♀, Loloipa, 1.i–15.iii.1958 (all *W. W. Brandt*) (100 BPBM, 10 BMNH); 1 ♂, Mt St Mary, 1900 m, 15–21.vii.1968 (*Mena*) (BPBM); 2 ♂, 2 ♀, Kamulai, 2200 m, 14.v.1972 [*J. N. L. Stibick*] (DAPM).

Specimens examined: 298; dissected: 23 (12 ♂, 11 ♀).

Doubtful records. The above record for Iemi No. 1 village must be regarded as doubtful; this locality is believed to be near Woitape. Specimens labelled as from Itikinumu Estate (1), Subitana (2) and Wau (2) are unlikely to be genuine and a series of 8 specimens, allegedly from the Toricelli Mts, are certainly wrongly labelled.

Bionomic data. 'On Brussels sprouts', 'On cabbage' (Kovatapa, S-I *et al.*); 'Feeding on foliage of *Coffea arabica*' (Metsialavava Pltn, S-I); 'On *Crotalaria anagyroides*' (Govt coffee block, Tapini, S-I); 'In garden, causing shot-hole damage to foliage of *Passiflora edulis*' (Tapini, S-I); 'Village garden, on *Phaseolus vulgaris* in dense population' (Perumeva, S-I *et al.*); 'Secondary forest, on *Piper* sp.' (Tatupiti, S-I); 'Secondary forest, on *Pipturus argenteus*, s. l.' (Tatupiti, S-I); 'Village garden, on pumpkin' (Lipuava, S-I *et al.*); 'Feeding on *Solanum tuberosum*' (Iemi No. 1, S-I); 'On sweet potato' (Metsialavava Pltn, S-I).

Local variation. Two forms of this subspecies can be distinguished. One occurs in the lower part of the Alabule river system, on the eastern side (Miss Cheesman's specimens); the observed size-range is 7·1–8·6 mm and the flagellum is ×0·15–0·19 as long as the pronotum. The other form occupies the upper part of the same system (from Tapini to Mt St Mary); they are larger, 7·6–10·2 mm in length and the flagellum is slightly longer, ×0·21–0·25 as long as the pronotum.

This subspecies resembles *A. c. cornutus* in general appearance but may be distinguished by its more slender antennal scape and finer setae, especially on the sides of the prothorax and near the apex of the elytra. In addition, the elytra of the male are flatter dorsally and the width of the prothorax of the female is always smaller, in relation to the width of the elytra, than it is in the male (♀: 0·48–0·51, ♂: 0·55–0·62), whereas in *A. c. cornutus* the ranges for the two sexes overlap.

The range of *A. c. tenuiscapus* coincides almost exactly with that of *A. canus*; they have been taken together on several occasions. The type-locality of *A. c. tenuiscapus* is the same as that of *A. asper*.

***Apirocalus (Apirocalus) cornutus virescens* subsp. n.**

(Figs 61–63, 172, 173, 181; Map 7)

Apirocalus cornutus Pascoe; Macleay, 1886 : 184 [?].

Range. Star Mts; Western District; Southern, Western and Eastern Highlands. Altitude: 400–1700 m.

Length 8·1–10·0 mm. Differs from the nominate subspecies as follows. Scales usually smaller, not, or less extensively imbricate, those on pronotum and elytra bright green or pale grey-green, those on head, antennal scape and legs coppery with green, blue and red reflexions; antennal funicle segments 4–7 more elongate, ×1·4–1·7 as long as broad; club slightly larger, ×1·7–1·9 as wide as funicle and ×0·86–1·00 as long as funicle segments 5–7 together; funicle segments with recumbent silky hairs, densest on segments 2 and 3, but rarely with any scales, setae on proximal segments almost as fine as those on distal segments; prothorax slightly more elongate (at least as long as broad in ♀) and distinctly smaller in ♀ than in ♂;

scales in middle of metasternum and venter smaller and well separated, setae finer and distinctly raised; fore coxae rarely with any scales, scales elsewhere on legs mostly smaller but a patch of large imbricate scales usually present on widest part of femora; segment 3 of tarsi usually without scales; elytral processes of ♂ usually longer and straighter, those of ♀ acute, their tips often produced beyond elytral outline, so that their spread about equals greatest width of elytra proper (Figs 61–63); EPI 132–148 (♂), 113–121 (♀); setae on postero-ventral aspect of prothorax of ♀ longer, on average, and clearly visible from above; ventrite 5 in both sexes weakly foveate and without longitudinal carinae.

Genitalia. Median lobe of aedeagus (Figs 172, 173) more slender, on average, than in *A. c. cornutus*, ×2·3–3·5 as long as broad, so that flagellum equals, or nearly equals, its width; struts, on average, shorter, ×1·1–1·4 as long as pronotum; intermediate section of internal sac with or without rows of pigmented denticles; gland-lobe of spermatheca (Fig. 181) broader and less well defined.

Holotype ♂, Irian Jaya: Star Mts, Sibil Valley, 1245 m, 18.x–8.xi.1961 (*S. Quate*), in BPBM.

Paratypes. Irian Jaya: 10 ♂, 5 ♀, same data as holotype (some *S. & L. Quate*) (11 BPBM, 4 BMNH); 4 ♂, 2 ♀, Star Mts, Bivac 36, 1220 m, 31.vii.1959 (*Leiden Mus. Neth. N. Guinea Exp.*) (RNH). Papua New Guinea: 5 ♂, 7 ♀, Western District, Olsobip, 400–600 m, viii.1969 (*J. & M. Sedlacek*) (10 BPBM, 2 BMNH); 1 ♂, 1 ♀, ditto, except 400 m and 26.viii.1969 (BPBM); 1 ♂, 3 ♀, Kuro River, 2.iii.1920 (*J. T. Zimmer*) (FMNH); 2 ♂, 2 ♀, Nomad, 25.x.1974 (*R. W. Hornabrook*) (2 RWH, 2 BMNH); 1 ♂, 1 ♀, Southern Highlands, Tari, Tigibi, 1600 m, 28.v–12.vi.1966 (*W. Vink*) (RNH); 1 ♂, Komo, 4800 ft [1440 m], 28.vii.1971 (*T. L. Fenner & R. Robartson*) (DAPM); 2 ♂, Nipa, Hegiso–Pimaga road, 25.xi.1969 (*B. Gray & H. Ivagai*) (DFB); 1 ♂, Lake Kutubu, 2400 ft [720 m], 17.ii.1971 (*R. W. Hornabrook*) (RWH); 1 ♂, Western Highlands, Hagen, Koibuga, 1500 m, 3.vii.1963 (*H. C[lissold]*); 2 ♂, 1 ♀, Eastern Highlands, Purosa, 1700 m, 17–25.v.1966 (*Gressitt & Tawi*); 1 ♀, Purosa, 1700–2000 m, 18.i.1966 (*J. Sedlacek*) (all BPBM); 2 ♂, Misapi, i.1968 (*R. W. Hornabrook*) (RWH, BMNH); 1 ♂, without locality (SAM).

Specimens examined: 58; dissected: 18 (15 ♂, 3 ♀).

Doubtful record. A series of five specimens in FMNH are labelled as taken at the Mongop Catholic Mission, New Ireland, by R. Starszak in 1967. Such a record would be inconsistent with the established distribution-pattern of the *cornutus*-group and I am bound to conclude that these specimens have been wrongly labelled.

Bionomic data. 'Native gardens' (Tigibi); 'On leaf of *Trema orientalis*' (Hegiso–Pimaga).

Local variation. The length of the elytral processes of the male varies with altitude as in *A. ebrius*; specimens from below 1000 m usually have EPIs below 140 whereas those from above 1000 m usually have EPIs above 140. When the processes are small, their inner margins conjointly describe a ± even curve but when they are large, the inner margins are straight and form a V in antero-dorsal view. Superimposed upon this variation is variation in the length of the median lobe of the aedeagus. In the west, as far east as Lake Kutubu, the median lobe is about half as long as the pronotum; from Lake Kutubu eastwards, it is three-quarters as long as the pronotum (though it is shorter in the two Purosa specimens).

The Gulf District form of the nominate subspecies is, in many respects, intermediate between typical *c. cornutus* and *c. virescens* but it has smaller elytral processes in the male and its body-scales are never green.

Apirocalus (Apirocalus) paradoxus sp. n.

(Figs 59, 60, 174, 175, 182; Map 7)

[*Apirocalus cornutus* Pascoe; Gray & Wylie, 1974 : 73, *partim.* Misidentification.]

Range. Chimbu; Southern and Eastern Highlands. Altitude: 1000–1680 m.

Length 7·8–10·5 mm. Female differs sharply from all other species in having elongate, tapering, incurving, caliper-like elytral processes (Fig. 60) with an extensive fringe of short, mostly pale setae along outer aspect (sometimes dark very near apex); elytral processes of ♂ (Fig. 59) normal, broad, resembling those of Brown River form of *A. cornutus* but more strongly diverging, their inner margins usually conjointly describing a smooth, even curve; EPI 130–140; setae of terminal fringe longer and all very pale brown (sometimes with a few shorter, dark setae at posterior end of fringe). Scales mostly small and separate, green or pale grey-green, those on femora usually very small, uniform and evenly distributed; widest part

of femora sometimes with larger, pink or coppery scales which may be locally subcontiguous but are rarely imbricate. Antennal funicle and segments 3 and 5 of tarsi without scales. Granules on pronotum more numerous and widespread than in *A. cornutus*, sometimes extending over entire dorsal surface. Elytral strial granules, on average, more prominent than in *A. c. virescens*; interstrial granules distinct. Rims of pterygia milled in both sexes; ♀ without any large erect setae on postero-ventral aspect of prothorax.

Genitalia. Median lobe of aedeagus (Figs 174, 175) ×0·8 as long as pronotum and ×3·7–4·2 as long as broad; struts ×1·4–1·6 as long as median lobe and ×1·2–1·4 as long as pronotum; flagellum shorter than greatest width of median lobe; internal sac with rows of pigmented denticles both in intermediate region and again posteriorly, where sac enters median lobe. Spermatheca (Fig. 182) as in *A. c. virescens*.

Holotype ♀, PAPUA NEW GUINEA: Chimbu, Karimui, 1000 m, 3.vi.1961 (*J. L. & M. Gressitt*), in BPBM.

Paratypes. PAPUA NEW GUINEA: 2 ♂, 4 ♀, same data as holotype (BPBM); 5 ♂, 9♀, ditto, except 2, 4, 5, 6, 7 and 8.vi.1961 (10 BPBM, 4 BMNH); 15 ♂, 8 ♀, Karimui, 2–3, 3 and 4.vi.1961 (*J. L. Gressitt*) (20 BPBM, 3 BMNH); 18 ♂, 6 ♀, Karimui, 1080 m, 8–10, 11–12, 13 and 14–15.vii.1963 (*J. Sedlacek*) (BPBM); 1 ♂, 1 ♀, Karimui, viii.1973 (*J. Sedlacek*) (CWO'B); 1 ♂, 4 ♀, Karimui, 1000 m, v.1969 (*H. Ohlmus*) (TM); 2 ♂, Karimui, 12.vi.1968 (*B. Gray*) (DFB); 8 ♂, 10 ♀, Karimui, *c.* 1972 (*R. W. Hornabrook*) (13 RWH, 3 BMNH, 2 MNHN); 1 ♀, Eastern Highlands, South Fore, Oriesa [*c.* 25 km SW. of Okapa], i.1964 (*R. W. Hornabrook*) (BMNH); 3 ♂, 4 ♀, Southern Highlands, Pangia, 5600 ft [1680 m], 17.vi.1975 (*R. W. Hornabrook*) (RWH).

Specimens examined: 103; dissected: 10 (6 ♂, 4 ♀).

Bionomic data. 'On *Hibiscus*', 'On leaf of shrub' (Karimui, BG). Gray's published record (Gray & Wylie, 1974 : 73) is 'On leaf of tree'.

The specimens from Pangia consistently have large coppery scales on their femora whereas in specimens from Karimui these scales are almost always small and green.

The development of the elytral processes of the female of this species is extraordinary and unique, though the Brown River form of *A. cornutus* may represent an early stage in a similar process of development. The fact that the pterygia of the female have milled rims (like the male) and that the long setae normally present on the postero-ventral aspect of the prothorax are absent, suggests that these apparent secondary sexual characters may be linked to the length of the elytral processes rather than to the sex of the specimen.

Apirocalus (Apirocalus) mus sp. n.

(Figs 21, 66, 67, 83, 183, 184, 206; Map 7)

[*Apirocalus cornutus* Pascoe; Ballard, 1927 : 298, *partim*. Misidentification.]

Range. Morobe District, Eastern Highlands. Altitude: 30–600(–1200 ?) m.

Length 5·7–7·0 mm. Black or reddish black, legs and antennae often more distinctly reddish; scales mostly pearly grey, very dense or imbricate except on antennal funicle and some tarsal segments; setae mostly pale and blunt. *Head* with frons distinctly declivous and finely rugose; eyes rather strongly convex but somewhat flattened on disc; rostro-frontal furrow wide and deep but true width concealed by overhanging scales; scales imbricate and compacted, becoming smaller, contiguous and metallic on vertex, those below eye imbricate but loose, those behind eye separate but very large, becoming smaller and sparser ventrally. *Rostrum* with sides weakly widening apicad, pterygia as wide as, or slightly wider than, genae; dorsal surface flat, sides distinctly emarginate behind antennal insertions; median carina variable, broad or narrow (sometimes obscured by scales), extending from base of rostrum to level of antennal insertions, or beyond; scales on dorsal surface (posterior to level of antennal insertions) imbricate and compacted, those on pterygia looser but still imbricate, extending thence to underside of base of rostrum. *Antennae* with funicle segments as in *A. cornutus*, except 1 and 2 equal and ×2·5 as long as broad; club (Fig. 21) ovate, stout, only twice as long as broad and 0·7–0·8 as long as 5–7 together but ×1·7–1·9 as wide as middle of funicle; funicle segments with dense silky hairs, broader, hence more conspicuous, on segments 1–3 and often accompanied on these segments by small, round, ovate or lanceolate scales; setae stiff, mostly brownish, blunt on proximal segments, grading to finely pointed on distal segments; scape as in *A. cornutus*. *Prothorax* as in *A. cornutus*, except length never exceeding breadth in ♂; discal

granules often arranged in two irregular rows in ♀, virtually absent in ♂. *Elytra* ovate, × 1·3 as long as broad in both sexes, sides evenly rounded, declivity steep, especially in ♂; suture weakly raised on declivity; disc evenly convex, more strongly so in ♀; strial punctures much larger than in *A. cornutus*, those on disc in ♂ often wider than the interstriae and regularly disposed, so that the interspaces form a rectangular mesh pattern (only visible in abraded specimens); strial granules minute or absent; interstriae each with a single row of mostly brown setae, similar in ♂ to those on sides of prothorax, in ♀ about twice as long and suberect; processes with dark, bronzy scales, declivity in ♂ with irregular but symmetrical dark marks (or dark with pale marks); setae in process fringes mostly dark brown but with some pale setae both anteriorly and posteriorly. *Sterna* and venter similar to those of *A. cornutus* but scales on ventrite 5 larger and more numerous. *Legs* as in *A. cornutus*, except hind femora subparallel near base (in profile view) and tarsal segments 3 and 5 without scales (segments 1 and 2 of fore and middle tarsi often scale-free also). *Sexual dimorphism* fairly well marked; ♂ with subhorizontal, blade-like processes (Fig. 66), similar to those of lowland *A. ebrius*, their spread only slightly exceeding greatest width of elytra proper; processes of ♀ (Fig. 67) forming a short crest, projecting posteriad, continuous or parallel with elytral outline when viewed from above; EPI 132–144 (♂), 127–133 (♀); prothorax relatively larger in ♂, its width × 0·62–0·66 that of elytra; prothorax of ♀ × 0·55–0·61 as wide as elytra; other differences as in *A. cornutus*.

Genitalia. Median lobe of aedeagus (Figs 183, 184) × 0·6–0·7 as long as pronotum, simple, evenly curved, × 2·3–2·4 as long as broad, apex weakly acuminate; struts × 2·5 as long as median lobe and × 1·5–1·6 as long as pronotum; flagellum ± straight, at least as long as median lobe and × 0·6–0·8 as long as pronotum; intermediate section of internal sac with double row of pigmented denticles. Spermatheca (Fig. 206) with tail very strongly flexed, strongly curved, weakly tapering; gland-lobe well defined, about as long as broad; gland pedunculate; duct-lobe elongate, tapering, ± straight; duct almost twice overall length of spermatheca.

Holotype ♀, Papua New Guinea: Morobe District, Singuawa River [15 km E. of Lae], 30 m, 11.iv.1966 (*P. Shanahan*), in BPBM.

Paratypes. Papua New Guinea: 4 ♂, 5 ♀, same data as holotype (6 BPBM, 3 BMNH); 2 ♂, 2 ♀, Bulem [Bulum] River, 64 km E. [*erratim* N.] of Lae, 30 m, 29.iv.1963 (*J. Sedlacek*) (BPBM); 1 ♂, Lae, Zenag, 20.iv.1965 (*Szent-Ivany*); 1 ♂, Nadzab, Pyramid Hill, 13.ix.1968 (*C. S. Li*); 1 ♂, Kaipit [Kaiapit], Sangar Pltn, 3.viii.1966 (*T. V. Bourke*) (all DAPM); 1 ♂, Kiapit, 950 ft [285 m], 19.ix.1925 (*E. Ballard*) (BMNH); 1 ♀, Markham River, 450 m, 18.vii.1963 (*J. Sedlacek*) (BPBM); 2 ♂, 2 ♀, Eastern Highlands, K[ai]n[an]tu, Kassam Pass, 2000 ft [600 m], 21.xi.1957 (*J. H. Barrett*) (2 DAPM, 2 BMNH); 1 ♂, 1 ♀, Morobe District, Bulolo, Sum Sum, 7–11.ii.1966 (*R. M. Stevens*) (DAPM); 1 ♂, 1 ♀, Bulolo, Sunshine Pltn, 20.iv.1965 (*J. Balogh & Szent-Ivany*) (TM); 1 ♂, Wau, 1200 m, 30.viii.1971 [*R. W. Hornabrook*] (RWH).

Specimens examined: 28; dissected: 11 (6 ♂, 5 ♀).

The above record for Wau requires confirmation.

Bionomic data. 'Nibbling on stem of *Imparata cylindrica*' (Zenag); 'From sugar-cane' (Pyramid Hill); 'On *Saccharum officinarum*' (Sangar Pltn); 'Ex cotton leaves' (Kaiapit, EB); 'In coffee blocks' (Sum Sum).

A. mus is the smallest member of the *cornutus*-group. Superficially, it closely resembles *A. ebrius* Faust but may be distinguished by its stouter antennal club and the lack of strial granules on the elytra. Its range lies entirely within that of *A. ebrius* and the two have been taken together on several occasions.

Apirocalus (Apirocalus) ebrius Faust **stat. n.**

(Figs 14, 17, 20, 22, 64, 65, 69, 70–74, 185–194, 197–204; Maps 5, 8)

Apirocalus cornutus Pascoe var. *ebrius* Faust, 1892 : 189.

Range. Northern New Guinea, Central Highlands, New Britain, Admiralty Is. Altitude: 0–2300 m.

Length 6·3–9·6 mm. Differs externally from *A. cornutus* only in its smaller average size, more strongly convex eyes and outline of elytra in ♂: sides, at process bases, shortly parallel or even converging posteriad (instead of widening throughout from base); ratio: width of prothorax/width of elytra, for the two sexes, does not overlap; ventrite 5 simple or weakly foveate in both sexes.

Genitalia. Flagellum very long, at least × 5 as long as median lobe; internal sac with unpigmented denticles. Spermatheca less plump than in *A. cornutus*; gland-lobe usually obsolete; duct very long (× 13 overall length of spermatheca in one measured example).

Hitherto confused with *A. cornutus* which has a more southerly range. Both species do, however, occur in the Central Highlands where their ranges are, as yet, imperfectly known.

Apirocalus (Apirocalus) ebrius ebrius Faust

(Figs 17, 20, 22, 64, 65, 73, 74, 185–190, 197–201; Map 8)

Apirocalus cornutus Pascoe var. *ebrius* Faust, 1892 : 189. LECTOTYPE ♂, PAPUA NEW GUINEA (SMT), here designated [examined].

[*Apirocalus cornutus* Pascoe; Ballard, 1927 : 298, *partim*; Szent-Ivany & Barrett, 1956 : 41; Szent-Ivany, 1956 : 83, *partim*; 1958 : 435; 1959 : 427, *partim*; Szent-Ivany & Barrett, 1960 : 10; Simmonds, 1960 : 54; Szent-Ivany, 1960 : 536; 1961b : 10; Simon Thomas & Verloop, 1962 : 33; Szent-Ivany 1965 : 25; Szent-Ivany & Stevens, 1966 : 116; Anonymous, 1966 : 113, 114; 1969 : 59, 60, 67; Le Pelley, 1968 : 111, 441, *partim*; Bourke, 1969 : 1421; Gray & Wylie, 1974 : 73, *partim*. Misidentifications.]

Range. As for *A. ebrius*, s. l., less part of northern Morobe District and part of Central Highlands. Altitude: 0–2300 m.

Length, ♂: 6·3–8·4 mm; ♀: 6·3–9·4 mm. Scales dense or imbricate, usually pale pearly grey (when clean but often stained brown); antennal funicle and tarsal segments with or without scales; antennal club × 2·1–2·9 as long as pronotum; elytral processes variable in ♂ (Figs 64, 73) but always with a distinct outer edge, stout and angulate in ♀ (Fig. 65); EPI 118–150 (♂), 108–121 (♀).

Genitalia (Figs 185–190, 197–201).

Lectotype ♂, PAPUA NEW GUINEA: with small square of gold-surfaced paper and 'N. Guinea / Richter'; 'ebrius / Faust' (Faust MS), in SMT.

Paralectotypes. 1 ♂, 2 ♀, labelled exactly as lectotype (SMT); 1 ♂, with 'Nov. Guinée'; 'Cotype'; 'Apirocalus ebrius Fst.' (Bovie MS); 'Collection Bovie / thru Buchanan' (printed) (NMNH). Faust records having 'zahlreiche Stücke' before him.

Distribution. Localities are listed, as far as possible, from west to east. IRIAN JAYA: Noemfor I.; Maffin Bay; Swart valley (Karubaka, 1300–1550 m; Kutsime; Guega); Archbold Lake, 760 m; Mulik River, 1050 m; Bokondini, 40 km N. of Baliem valley, *c.* 1300 m; Dafo; Genjam; Hollandia (Cyclops Mts; Lake Sentani; Tana Mera; Waris; Dojo; Kota Nica; Humboldt Bay; Pukusam Dist., W. of Tami River); Bewani Mts. PAPUA NEW GUINEA: West Sepik District, Toricelli Mts (Siaute, sea level; Mobitei; Mokai; Sugoitei); W.S.D., Main [? May] River; East Sepik District, Dreikikir; E.S.D., Maprik (Bainyik; Kukwal; Suanimbu; Kaboibus); E.S.D., Wewak [Dallmannhafen] (Borum; Negoo Pltn); Western Highlands, Jimi River, 1400 m; W.H., Upper Jimi Valley (Wum, 840 m; Tsenga, 1200 m; Korop, 1300 m; Wana, 1500 m); Chimbu District, Chimbu Valley; C.D., Karimui; C.D., Nomane; Madang District, Bogia [Monumbo]; M.D., Aly; M.D., Tumleo; M.D., Dugumor Pltn; M.D., Adelbert Range (Wanuma, 800–1000 m; Utu); M.D., Alexishafen; M.D., Madang [Friedrich Wilhelmshafen] (Nagada Pltn; Dylup Pltn; Beon Nursery; Baitabag; Silibolo); M.D., Gogol River; M.D., Astrolabe Bay (Erema; Stephansort); M.D., Bundi, Bundikara, *c.* 30 km E. of Mt Wilhelm, 1650 m; M.D., Finisterre Range, Naho Valley (Damanti, 1065 m; Budemu, 1200 m; Moro, 1665 m); M.D., Saidor (Sibog, 500 m; Galumi, 600 m; Kiambavi, 1400 m); M.D., Karkar I.; M.D., Crown I.; M.D., Long I; Eastern Highlands, Goroka (Greathead's Pltn; Downes Pltn); E.H., Asoro; E.H., Okapa (Okasa; Agakamatasa); E.H., Kainantu (Tutor's Pltn; Yonki); E.H., Kassem Pass; E.H., Aiyura (Brechin Pltn; Kuminikura Pltn; Akivitana River); E.H., Gadsep, Arau; Morobe District, Umboi I. (Awelkom to Semo), 470–600 m; M.D., Kaiapit; M.D., Munum; M.D., Pyramid Hill; M.D., Wantoat; M.D., Boana Mission; M.D., Lambaeb, 900 m; M.D., Melambi River (Gawan, 600 m; Zitare, 1800 m; Samazing, 2100 m); M.D., Kalalo; M.D., Hudewa; M.D., Pindiu; M.D., Sattelberg; M.D., Finschhafen (Wareo; Timbulum Pltn); M.D., Bulem [Bulum] River; M.D., Rawlinson Range; M.D., Lae (and district); M.D., Kankumun;

M.D., Wanuru Pltn; M.D., Leuvomba; M.D., Bubia; M.D., Butibam; M.D., Gurakor; M.D., Nadzab [often written 'Nadyab']; M.D., Lake Wanum; M.D., Pesen; M.D., Markham River, 50 m, 450 m; M.D., Herzog Mts, Vagau, 1200 m; M.D., Snake River, 600 m; M.D., Muming [Mumeng], Mapos; M.D., Kuper Range; M.D., Mt Missim, 880–1400 m; M.D., Baimu River; M.D., Bulolo (and district), 700–1300 m; M.D., Wau (and district), 960–1700(–2500 ?) m; M.D., Edie Creek, 2000 m; M.D., Mt Kaindi, 2300 m; M.D., Asiki [Aseki]; M.D., Garaina; M.D., Pater Creek, 110 km S. of Lae; Northern District, Popondetta; N.D., Igora Pltn; N.D., Oro Bay (at N. end of Dyke Ackland Bay); Manus District, Manus I. (Lorengau; Momote); New Britain, Nakanai Mts (Talalo; Ti; Gisiluve), 900–1050 m; N.B., north coast, Sio, 600 m.

Specimens examined: 3470; dissected: 124 (80 ♂, 44 ♀).

Additional (published) records. Sepik District, Tamaui Pltn (Szent-Ivany, 1959 : 427); Madang District, Mirap; Morobe District, 17 km NE. of Biawa (Gray & Wylie, 1974 : 73, 74). Some records for the Central Highlands, given in the above papers under *A. cornutus*, may refer to the nominate subspecies, or to *A. e. angustus* or even to members of other species-groups. Records for Northern District may refer to *A. e. ebrius* or to *A. hydrographicus*; specimens of both have been seen from Igora Pltn and Popondetta.

Doubtful records. Those for Chimbu District (cited above) require confirmation. Some of Wagner's localities are very imprecise; for example, his Cromwell Range series includes both *A. e. wagneri* and *A. e. ebrius* (lowland form). Specimens in BPBM labelled 'New Britain, Gazelle Pen., 130 m' are of the upland form while some at least of the specimens labelled 'Neu Pommern' are known to be from New Guinea (see *A. e. wagneri*). Hence there are no undoubted lowland records for New Britain (or Umboi I.). DAPM specimens from Hohola, Port Moresby (♂) and M and V Estate, Ihu (♀) have almost certainly been wrongly labelled. Specimens from Daru I. and Oriomo River (Western District), both taken by H. Clissold early in 1964, support each other but, if genuine, can only be the result of an introduction. Other possibly introduced specimens include two from the Solomons (3.viii.1965, in FMNH) and two from the Philippines (Mindanao, Agusan, 13.xi.1959, in BPBM). Finally, there is a specimen in the Bovie collection (NMNH) labelled 'Nov. Hébrides'; 'Heller' and determined as *A. cornutus* by Heller.

The earliest dated specimen I have seen is a female from the Oberthür collection (MNHN) labelled 'Humboldt Bay. / Sept.–Oct. 1893 / W. Doherty' (printed) and 'var. / ebrius Fst.' (Faust MS) but the type-series is older (pre-1892).

Biological data. *A. e. ebrius* has been found on some fifty plants of various types, herbs, shrubs and trees. It has been observed eating the leaves of coffee, cacao, tea, taro, soya bean, cowpea, *Verbena* sp. and *Crotalaria* sp. There are also published records of it damaging leaves and flowers of banana (Szent-Ivany & Barrett, 1956 : 41), maize, pawpaw, mango, *Cassia* sp., *Cinchona* spp., *Grevillea robusta* A. Cunningham, *Euphorbia pulcherrima* Willdenow, *Cucurbita pepo* Linnaeus, *Paspalum conjugatum* Bergius, *Panicum palmaefolium* [*erratim palmarum*] Koenig (Szent-Ivany, 1958 : 435) and cotton (Ballard, 1927 : 297).

Local variation. Lowland populations, throughout the entire range, have small elytral processes in the ♂ and dense scales on funicle segments (1–)2–4(–6), tarsal segments 1 and 2 (3, 5) and fore coxae (at least on mesal aspect). Populations at higher levels have progressively larger processes (in the ♂), no scales on the fore coxae and show a progressive reduction in size and extent of the scales on the funicle and tarsi (see Fig. 22). Although scales disappear completely from the antennal funicle and fore and middle tarsi in some upland populations, they are retained on segments 1 and 2 of the hind tarsi. Elytral processes of the female are obtuse in lowland populations but right-angled or acute at higher altitudes (scales vary as in male). Some small, elongate males from Finschhafen superficially resemble *A. mus*; they may be distinguished from the latter by their much longer flagellum and the presence of distinct granules on the pronotum and along the elytral striae (these granules are obsolete in *A. mus*). The sample from Manus I. consists of 3 males and 2 females, measuring only 6·4–7·2 mm and having scales on segment five of each tarsus; similar specimens have, however, been observed among those from Finschhafen. The length of the flagellum varies from × 2·3 to 4·3 the length of the pronotum but is more restricted in any given population. Thus nine specimens from Oro Bay range from × 3·15 to 3·65. Specimens from Garaina, Wau, Mt Missim, Kassem Pass, Aiyura, Damanti (Finisterre

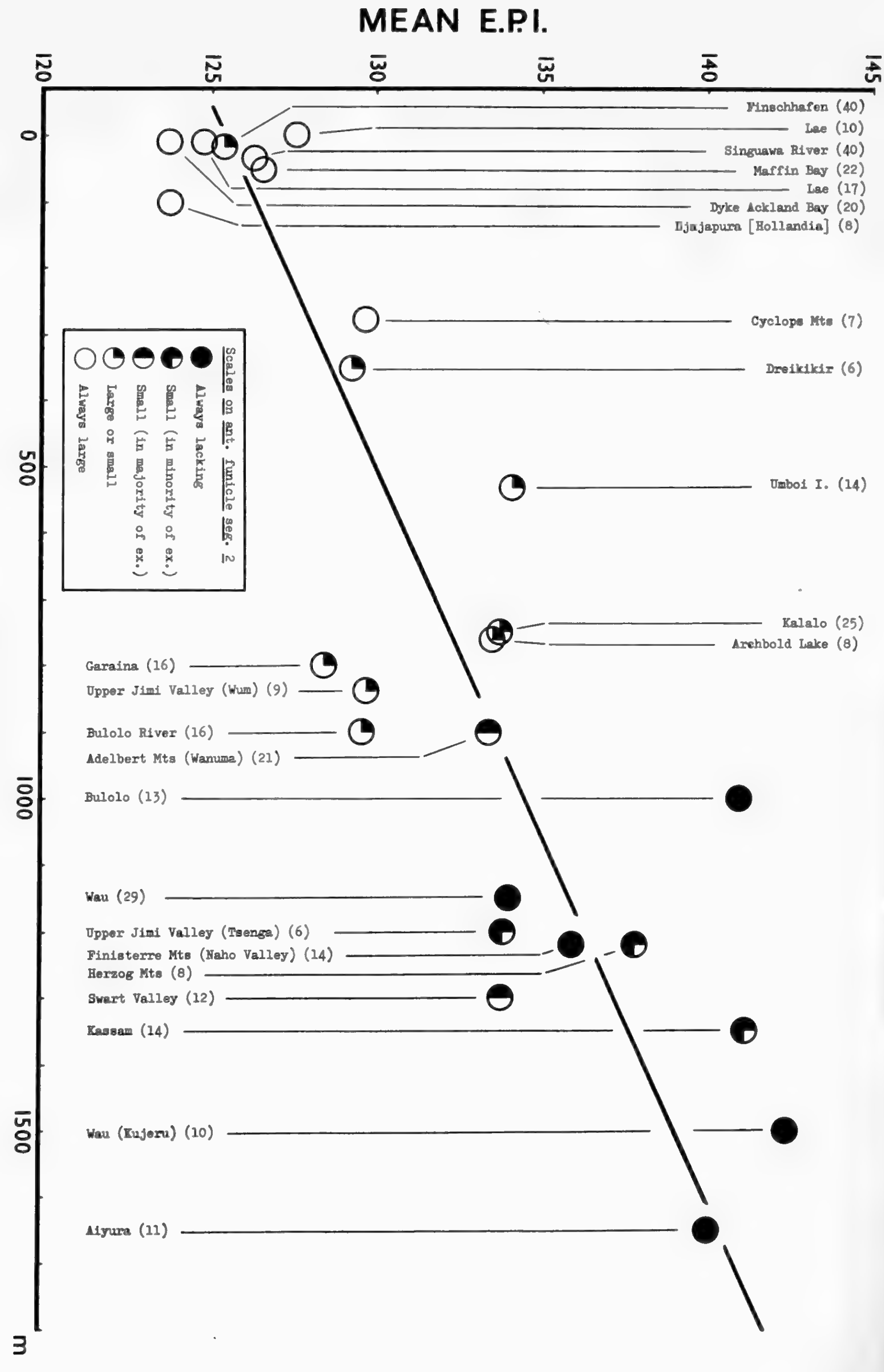


Fig. 22 *Apirocalus e. ebrius.* Graph showing relationship of length of elytral processes (as indicated by the EPI – see Fig. 3) and incidence of scales on antennal funicle and tarsi, to altitude. Number of specimens in each series is shown in brackets. ($y = 125{\cdot}4 + 0{\cdot}009x$; $r = 0{\cdot}897$) Discussion, p. 243.

Range) and Noemfor I. have similar ranges but five from Maffin Bay are ×2·3–2·5 as long as pronotum and two from Herzog Mts are ×4·1 and 4·3 as long. This variation is independent of the altitudinal variation and has no discernible pattern.

Owing to convergence in superficial characters (especially those of scales and setae) in the lowland environment, *A. e. ebrius* closely resembles *A. c. cornutus* and has been confused with it by all previous workers except Faust, whose description has been overlooked. *A. c. cornutus* can usually be distinguished by its less convex eyes but single specimens, especially females, may have to be checked by dissection; indeed, one female of *cornutus* from Bisianumu has eyes fully as convex as typical *ebrius*. The size-ranges of these two taxa overlap widely but when good series are examined, a pronounced difference in size is apparent. Thus, a series of *cornutus* from Yule I. measured:

♂: 7·3–9·7 ($\bar{x}$ (25)=8·5); ♀: 7·8–9·9 ($\bar{x}$ (25)=9·0) mm,

while a series of *ebrius* from Lae (Singuawa River) measured:

♂: 6·3–8·3 ($\bar{x}$ (25)=7·1); ♀: 7·1–8·8 ($\bar{x}$ (25)=7·8) mm.

A. e. ebrius is the commonest, most widespread and most important member of the genus; if Faust's name be taken to mean 'plentiful', it could scarcely be more appropriate.

Among the various upland forms there are two, both peripheral (but not isolated), which differ so strongly from the rest as to demand formal recognition. They are described hereunder as subspecies.

Apirocalus (Apirocalus) ebrius wagneri subsp. n.

(Figs 14, 71, 72, 193, 194, 203, 204; Map 5)

Range. Northern Morobe District. Altitude: 1200–1920 m.

Length, ♂: 6·7–8·5 mm; ♀: 7·6–9·6 mm. Differs from upland forms of the nominate subspecies as follows. Elytral processes of ♂ (Fig. 71) narrower, often set closer together, terete and strongly tapering (hence with narrower apical fringe), sometimes steeply rising or curving laterad; sides of elytra distinctly narrowed in front of process bases, making elytra appear more elongate; EPI 133–147 (♂), 108–120 (♀); scales on femora mostly small and separate, often pearly or coppery, contrasting with grey-green scales on body; strial granules larger in both sexes, usually at least as large as surrounding scales; antennal club larger, ×0·30–0·35 as long as pronotum; funicle segments rarely with any scales; scales usually present on segments 1 and 2 of hind (and sometimes middle) tarsi; setae on postero-ventral margin of pronotum of ♀ often reduced or absent; flagellum longer (on average).

Genitalia (Figs 193, 194, 203, 204).

Holotype ♂, Papua New Guinea: [Morobe District, Huon Peninsula], Komba (*L. Wagner*), in SAM.

Paratypes. Papua New Guinea: 12 ♂, 10 ♀, same data as holotype (16 SAM, 6 BMNH); 8 ♂, 4 ♀, Cromwell Range, vii.1929 (*L. Wagner*) (9 AMNH, 3 BMNH); 1 ♂, Finsch Haven [Finschhafen], Wareo (*L. Wagner*) (SAM); 4 ♂, 2 ♀, Salawaket [Saruwaged] Range, Baindoang, 1800 m, 15.ix.1956 (*E. J. Ford, Jr*) (3 BPBM, 3 BMNH); 2 ♂, 3 ♀, Sepalakambang, 1920 m, 11–14.ix.1956; 1 ♂, 1 ♀, Gewak, 1530 m, 7.ix.1956; 1 ♂, Baindep, 1260 m, 16.ix.1956 (all *E. J. Ford, Jr*) (all BPBM); 9 ♂, 5 ♀, Finisterre Range, Saidor, Funyende, 1200 m, 24 and 24–30.ix.1958 (*W. W. Brandt*) (10 BPBM, 4 BMNH); 2 ♂, 1 ♀, Saidor, Matoko [1500 m], 6–24.ix.1958 (*W. W. Brandt*) (BPBM).

Specimens examined: 67; dissected: 23 (16 ♂, 7 ♀).

Doubtful records. The specimen labelled 'Wareo, Finsch Haven' in the above list almost certainly came from the inland ranges. Two males labelled 'Neu-Pommern / coll. Plason' undoubtedly belong to this subspecies but I do not believe that it occurs in New Britain.

Local variation. Although the Funyende specimens have the main distinguishing characters of this subspecies (their strial granules are even larger than those of the other paratypes), the females have normal setae on the postero-ventral margin of the prothorax and the flagellum of the male is shorter, ×3·5–4·0 as long as pronotum (×4·3–4·9 in the other series). Also the spermathecae from two Komba specimens have distinct gland-lobes, whereas those from Funyende

do not. These differences indicate that the Funyende population is, to some extent, intermediate between this subspecies and the nominate. The latter occurs in the vicinity of Funyende but mostly at lower altitudes.

This subspecies bears a strong superficial resemblance to *A. atrigenua* which occurs in the same area (at higher altitude); the latter may be distinguished by its more slender antennal scape, more strongly convex eyes, (mostly) dark femoral setae and flattened or depressed pronotal disc.

Apirocalus (Apirocalus) ebrius angustus subsp. n.

(Figs 69, 70, 191, 192, 202; Map 5)

Range. Eastern Highlands and Chimbu Districts. Altitude: 1500–2000 m.

Length, ♂: 6·3–7·6 mm; ♀: 7·3–8·4 mm. Differs from upland forms of *A. e. ebrius* as follows. Elytral processes of ♂ (Fig. 69) set closer together, less strongly diverging, their inner margins straighter, outer halves strongly depressed, forming a thin flange which is distinct from thick inner half of process; processes of ♀ (Fig. 70) shorter and more strongly diverging, either blade-like, with broad fringe (resembling ♂ of lowland form of *A. e. ebrius*) or more strongly tapering (but with distinct outer edge); EPI 142–158 (♂), 130–148 (♀); elytral suture narrowly and very sharply raised on declivity in ♂ and sometimes in ♀ (not, or bluntly raised in *A. e. ebrius*); strial punctures smaller, granules always very small; scales smaller, mostly contiguous rather than imbricate, those on distal half of processes and disc of ventrites 1 and 2 more strongly ovate or elongate; setae on postero-ventral margin of prothorax of ♀ fewer and smaller (shorter than segment 3 of antennal funicle).

Genitalia (Figs 191, 192, 202).

Holotype ♂, Papua New Guinea: 'Bismarck Gbg, Waghital' [? Wahgi valley], 5000–7000 ft [1500–2100 m], 1963 (*C. Voss*), in MGF.

Paratypes. Papua New Guinea: 4 ♂, 4 ♀, same data as holotype (5 MGF, 3 BMNH); 3 ♂, 2 ♀, Eastern Highlands, Mt Michael, Lufa, Frigano Road [1800 m], 9.iii.1974 (*R. W. Hornabrook*) (4 RWH, 1 BMNH); 3 ♂, South Fore, Lamari River, 28.xi.1963 and 28.iii.1964 (RWH).

Specimens examined: 17; dissected; 9 (7 ♂, 2 ♀).

Bionomic data. 'On acacia in grassland' (Frigano Road).

The range of this subspecies is uncertain. The type-locality is possibly near Omkalai (Chimbu District, 20 km S. of Kundiawa) since the Wahgi River crosses the 7000 and 5000 ft contours just north of it. Such a location would be congruent with the record for Mt Michael but leaves that for Lamari River somewhat isolated.

A very extraordinary specimen in DAPM (Kainantu, Arona, 25.i.1964) is undoubtedly female but has elongate, flattened, very weakly diverging and steeply rising elytral processes with entirely whitish fringing setae.

Some specimens of the nominate subspecies from adjoining localities, notably Goroka, Kainantu and Aiyura, bear a superficial resemblance to *A. ebrius elongatus*, even to having elongate elytral processes in the female but such females have large setae on the postero-ventral margin of the prothorax and normal scales on the elytral processes and venter; many normal specimens are known from these localities.

It is a singular fact that both the above subspecies, which represent quite different extremes of variation within the *ebrius*-complex, show a marked reduction in size of the prothoracic setae which are otherwise characteristic of the female sex throughout the *cornutus*-group (except *A. paradoxus*).

Apirocalus (Apirocalus) hornabrooki sp. n.

(Figs 68, 195, 196, 205; Map 5)

Range. Madang District (Karkar I.). Altitude: *c.* 1500 m.

Length 8·2–11·2 mm. Entirely black; femora, antennal funicle and tarsal claw-segments sometimes slightly reddish; scales dense, pale greyish or brownish (stained ?). Otherwise differs from *A. cornutus*

virescens as follows: scape slightly longer, ×0·9–1·0 as long as pronotum (×0·8–0·9 in *A. c. virescens*, longer, on average, in ♀ in each case) but similar in width, hence more slender; eyes slightly smaller but of similar convexity; scales on legs as large as those on elytra, matt, mostly pale bluish grey (not smaller and coppery), those on vertex of head and antennal scape also bluish; scales in middle of metasternum and venter almost as large and dense as those near sides; tarsi with, at most, a few small scales on segments 1 and 2 of middle and hind tarsi; sides of elytra (Fig. 68) narrower at process bases, planes of processes less strongly tilted inwards; processes of ♀ right-angled, their spread slightly less than greatest width of elytra proper; EPI 143–152 (♂), 114–116 (♀).

Genitalia. Median lobe of aedeagus (Figs 195, 196) half as long as pronotum and ×2·6–3·0 as long as broad; struts ×2·4–2·7 as long as median lobe and ×1·3–1·5 as long as pronotum; flagellum ×2·5–2·7 as long as pronotum (two observations), basal sclerite with spur; internal sac with unpigmented denticles. Spermatheca (Fig. 205) slender; tail as long as or longer than body, strongly reflexed, tapering; gland-lobe obsolete; gland slender; duct very long (not measured).

Holotype ♂, Papua New Guinea: [Madang District], Korker [Karkar] I., crater rim [*c.* 1500 m], 25.iii.1972 (*R. W. Hornabrook*), in BMNH.

Paratypes. 6 ♂, 3 ♀, same data as holotype (6 RWH, 2 BMNH, 1 BPBM).

Specimens examined: 10; dissected: 5 (3 ♂, 2 ♀).

In spite of its large size, the long flagellum and spermathecal duct show clearly that this species is related to *A. ebrius* rather than to *A. cornutus*.

The *strigifrons*-group

Apirocalus (Apirocalus) strigifrons sp. n.

(Figs 211, 212, 233; Map 6)

Range. Morobe District. Altitude: 2070–(?) 2800 m.

♀. Length 7·3–8·3 mm. Black, femora and tibiae red. Scales generally small, separate, dull brown or greenish (not imparting any colour to cuticle) with some larger, brighter green scales either scattered or in small groups; elytral declivity with much larger scales, of various colours, forming a pale transverse band between elytral processes. *Head* with frons moderately declivous, entirely covered with strong, ± regular rugae but without any median carina; eyes moderately convex (about as in *A. ebrius*); scales very small, mostly brown, confined to grooves between rugae with a few larger scales below eyes; setae above and below eyes small, fine, mostly white. *Rostrum* ± parallel-sided, pterygia very slightly wider than genae; upper surface ± flat, distinctly narrowed behind antennal insertions and there strongly and irregularly rugose, seldom with a distinct median carina; scales as on frons; setae white. *Antennae* with funicle segments 1 and 2 subequal, 3–6 subequal and about half as long as 2, 7 usually (but not always) distinctly longer than 6 and ×1·2–1·7 as long as broad; club ovate, ×2·2–2·3 as long as broad and ×0·3 as long as pronotum; scape stout, weakly sinuous, strongly flattened, ± parallel-sided in distal two-thirds, apex strongly capitate, the expansion asymmetrical, greatest anteriad; upper surface with strong rugulae and scattered lipped punctures; setae mostly stouter than those on funicle, moderately curved, semi-erect, mostly white along leading edge, mostly brown elsewhere, the longest distinctly shorter than greatest diameter of scape in middle of length; scales mostly green, mostly confined to grooves between rugulae; funicle segments with very sparse recumbent silky hairs. *Prothorax* slightly longer than broad, widest about middle, sides moderately rounded apicad, weakly rounded basad, without any constriction; disc of pronotum flat, flattened area well defined (at least at sides), either quite flat or with ill-defined cariniform elevations in mid-line in anterior half and near base; surface very finely granulate, sometimes with scattered larger granules; sides finely and irregularly rugose; scales on disc no larger than those on scape, separate and inconspicuous; scales on sides much larger, often bright green, especially on lower part of sides; setae on sides similar to those on scape but subrecumbent, usually brown and inconspicuous. *Elytra* cordate, ×1·1–1·2 as long as broad, sides strongly rounded near base; disc ± flat, flattened area ending ± abruptly in interstria 5; declivity steep; suture weakly but sharply raised on declivity and posterior half of disc; surface of elytra shagreened and with scattered microgranules which sometimes coalesce to form minute transverse rugulae; striae not or weakly impressed; strial punctures well defined but very small (scarcely larger than largest surrounding scales); strial granules about as large as strial punctures and each with a small brown seta projecting posteriad across puncture; interstrial granules similar to strial granules but fewer and bearing much larger setae, some of those near sides longer than those on scape; elytral processes subhorizontal (dorsal surface ± in line with that of elytra proper), elongate, evenly

tapering, somewhat flattened but terete, weakly diverging, so that spread is less than greatest width of elytra proper (sometimes much less); apex narrowly rounded, asymmetrical, fringing setae mostly brown or blackish, longest about equal to greatest width of hind femora (in dorsal view), often spreading over upper surface of process; EPI 133–142. *Mesepisterna* and arms of mesosternum with a few large punctures, a few scales and a few small setae. *Mesosternum* with large but separate scales (subcontiguous towards sides but not imbricate); ventrites 1 and 2 with much smaller, well separated scales; ventrites 3–5 with even smaller, sparser, scales; setae throughout very fine, hyaline or brownish. *Legs* with femora moderately swollen; fore and middle tibiae straight or weakly incurved very near apex, hind tibiae straight; hind tarsal claw-segment ×2·0 as long as segment 3; scales green, mostly small and well separated but larger and sometimes subcontiguous on widest part of femur, those on tibiae sometimes subcontiguous along outer (dorsal) edge; setae on femora and tibiae fine, pale, shorter on average than those on scape, those on knees arising from small granules; setae on tarsi all very pale; segments 1 and 2 of hind tarsi with an occasional elongate scale among the recumbent hairs.

Genitalia. Spermatheca (Figs 211, 212) with tail about as large as body, body curving 'dorsad' and merging with tail in an even curve; gland-lobe distinct, variable, gland claviform or pedunculate; duct-lobe large, variously flexed, two-thirds length of body; duct several times overall length of spermatheca; styli of ovipositor ×4·4 as long as broad.

Holotype ♀, Papua New Guinea: Morobe District, Bulldog Road, *c*. 14 km S. of Edie Creek, 2405 m, 4.v.1969 (*J. Sedlacek*), in BPBM.

Paratypes. Papua New Guinea: 1 ♀, same data as holotype except 4–10.vii.1966 (*G. A. Samuelson*); 1 ♀, Bulldog Road, 40 km S. of Wau, 2100–2800 m, 22–31.v.1969 (*J. Sedlacek*) (both BPBM); 1 ♀, Bulldog Road, 60 km S. of Wau, 2070 m, 22–31.v.1969 (*J. Sedlacek*) (BMNH).

Specimens examined: 4; dissected: 3 (♀).

A distinctive species, clearly related to the *olivaceus*-group but distinguished from it by the broad, strongly capitate antennal scape and the elongate seventh funicle segment. The scape is similar to that of *A. acutus* but these two species have little else in common.

The *acutus*-group

Apirocalus (Apirocalus) acutus sp. n.

(Figs 18, 19, 207–210, 241; Map 6)

Range. Morobe District. Altitude: 1200 (?)–2350 m.

Length 9·5–10·0 mm. Black, antennae, femora and tibiae reddish black; scales bright orange-brown and/or pale green with variable admixture of brown or blackish scales; scales on declivity not paler than elsewhere. *Head* with frons weakly declivous, ± distinctly rugose and with trace of median carina; eyes moderately convex (about as in *A. cornutus*); scales small, contiguous but not concealing frontal rugae; setae very fine and inconspicuous. *Rostrum* as elongate as in *A. cornutus*; sides tapering to middle, widening again at genae; pterygia slightly wider than genae, their rims microreticulate in both sexes; dorsal surface ± flat, distinctly narrowed behind antennal insertions, with a distinct (♂) or very stout (♀) median carina; dorsal surface and genae with ± contiguous scales and mostly white setae. *Antennae* dimorphic (see below); scape sinuous, strongly capitate, apex truncate; setae on leading edge sparse, erect or semi-erect, brown and white, as fine as those on funicle, not exceeding greatest width of scape in middle of length; funicle segments with very fine recumbent silky hairs but no scales; club ×0·3 as long as pronotum. *Prothorax* distinctly longer than broad in ♂, slightly longer in ♀, widest in or slightly in front of middle, tapering or weakly constricted basad, weakly to moderately rounded apicad; sides of disc of pronotum strongly raised, the elevations clearly defining an ovate, flat or weakly concave area, extending for almost entire length of pronotum and about three-quarters of its width; sculpture and vestiture as in *A. olivaceus*. *Elytra* < ×1·4 as long as broad in ♂, ×1·3 as long in ♀, strongly dimorphic (see below); strial punctures very small or obsolete on disc, distinct on sides but often concealed by scales; strial and interstrial granules similar, ± scale-size and with minute setae throughout in ♂; setae near sides larger in ♀ but smaller than those on leading edge of scape; top of declivity with a prominent scale-free band, extending along processes to near apex. *Mesepisterna* with cluster of punctures, scales and small setae in posterior half; arms of mesosternum bare, sometimes with a few punctures. *Metasternum* and ventrites 1 and 2 with contiguous or narrowly separated scales, similar to those on elytra; ventrites 3–5 with sparser, smaller scales; setae fine, whitish or brownish. *Legs* with femora weakly to moderately

swollen, with mostly narrowly separated scales, smaller than those on elytra; setae white, semi-erect, a little shorter and stouter than those on leading edge of scape; tibiae rugulose, with scales similar to those on femora and semi-erect, brownish setae; tarsi with few recumbent silky hairs and no scales; hind tarsal claw-segment × 1·8 as long as segment 3 in ♂, × 2 as long in ♀. *Sexual dimorphism* strong, affecting antennae (Figs 18, 19) and legs, as well as elytra. Antennae of ♀ stouter than those of ♂ in all their parts; funicle of ♂ normal, segments 3–7 longer than broad (7 only slightly longer); ♀ with segment 3 slightly longer than broad but segment 4 quadrate and 5–7 increasingly broader than long (10: 11, 10: 13, 10: 14), 6 and 7 chestnut-shaped and pressed close together; club of ♂ elongate, × 3 as long as broad but in ♀ stouter, × 2·3 as long as broad; scape of ♂ slender, widening gradually from base to apical expansion which projects anteriad in form of a triangle; scape of ♀ stouter, widening more strongly apicad, anterior part of apical expansion taking the form of a hook. Legs of ♂ with fore femora strongly arched in basal third, middle and hind femora very weakly arched; fore femora of ♀ weakly arched, middle and hind femora straight; fore tibiae of ♂ very strongly and rather abruptly incurved in apical third but fore tibiae of ♀ less strongly and more evenly incurved. Elytra of ♂ narrow, sides almost straight, disc almost flat, apex simple; processes short, angular, mesal (posterior) margins straight or concave, making a very obtuse angle with each other, outer margins convex, with sharp edges which continue (less sharply) along sides almost to base; elytra of ♀ convex, rounded at sides, apex narrowly but deeply emarginate; processes very short, rounded, narrower than elytra proper, projecting feebly posteriad, their outer edges produced as a tectiform carina across disc of elytra in direction of eye of opposite side, stopping short at level of metasternum.

Genitalia. Median lobe of aedeagus (Figs 208–210) × 0·8 as long as pronotum and × 3·7 as long as broad, strongly curved and with elongate apical region; struts × 1·4 as long as median lobe; flagellum small, *c*. × 0·4 as long as median lobe and *c*. × 0·3 as long as pronotum (one observation, specimen defective); part of internal sac with double row of large brown denticles. Spermatheca (Fig. 207) similar to that of *A. cornutus*; duct about × 2·5 overall length of spermatheca; styli of ovipositor × 3·5 as long as broad.

Holotype ♂, PAPUA NEW GUINEA: Morobe District, Mt Kaindi, 16 km S. of Wau, 2300 m, 8–9.vi.1962 (*J. Sedlacek*), in BPBM.

Paratypes. PAPUA NEW GUINEA: 1 ♀, Mt Kaindi, 2350 m, 30.iv.1966 (*J. L. Gressitt*) (BPBM); 1 ♂, Wau, 1200–1300 m, 6.vi.1962 (*J. Sedlacek*) (BMNH).

The Wau male was originally intended to be the holotype and has not, therefore, been dissected. The other, dissected, male has been chosen instead because I am not entirely convinced that the Wau record is genuine.

A bizarre species, exhibiting several unique features, notably the curvature of the fore femora of the male and the transverse funicle segments of the female. I have placed it near the *olivaceus*-group on account of its elongate aedeagus and the similar sculpture of the prothorax.

The *olivaceus*-group

Elytral processes variable but without any discrete swelling at base. Surface of elytra behind shoulder region often flattened or depressed; striae on disc often non-parallel. Entire upper surface of prothorax ± uniformly ruguloso-granulate, the granules usually no larger than those on base of elytra, often ill-defined or confused; a large part of disc usually flattened or depressed; traces of a narrow median carina often present. Rostrum parallel-sided; pterygia reduced, at most as wide as genae; upper surface usually evenly transversely convex throughout. Antennal scape (Fig. 15) straight (beyond basal third), ± flattened but slender, widening very gradually to apex, without any apical expansion or pre-apical constriction; setae erect or semi-erect, usually brown, shorter than those on funicle and almost as fine; funicle segments with sparse recumbent silky hairs and no scales; club fusiform, × 0·27–0·34 as long as pronotum. Mesepisterna densely squamose, at least posteriorly; arms of mesosternum with or without scales. Median lobe of aedeagus variable, × 2·9–5·9 as long as broad; flagellum long, × 1·5–3·2 as long as pronotum. Spermatheca variable; styli of ovipositor × 3–4 as long as broad.

A well defined group of montane species, occupying almost exactly the same range as the *avus*-group. The female of one species (*A. stellifer*) has the large prothoracic setae and smooth pterygial rims characteristic of females of the *cornutus*-group. The traces of a median carina on the pronotum have a parallel in the closely-related genus *Hellerrhinus* Marshall. All four species are new.

Apirocalus (Apirocalus) stellifer sp. n.

(Figs 213, 220, 221, 237; Map 6)

Range. Eastern Highlands and Morobe District (Wau). Altitude: 1200–*c.* 2000 m.

Length, ♂: 6·7–7·1 mm; ♀: 7·5–8·3 mm. Black, legs and antennae dark red (tarsi blackish); scales mainly bright rust-brown or olive with a pearly or creamy white blotch on disc of elytra and another on declivity (Fig. 237). *Head* and *rostrum* as in *A. olivaceus* except frons always gently declivous and sides of rostrum parallel or weakly widening at genae (never tapering apicad). *Antennae* with funicle and club as in *A. olivaceus*; scape stouter, upper surface more distinctly rugulose and with larger setae, those on leading edge mostly distinctly longer than width of funicle segments and usually pale or reddish brown. *Prothorax* as long as broad or slightly longer (especially in ♂), sides weakly to moderately rounded, without any pre-apical constriction; disc of pronotum broadly flattened but not (transversely) depressed, sculpture as in *A. olivaceus* except rugulae not radiating, granules in centre even less distinct and traces of median carina usually more extensive; scales contiguous (between granules, etc.) and not, or very slightly, larger on sides than on disc, often imbricate and paler towards hind angles; setae larger (similar to those on scape) but concolorous with scales, hence inconspicuous. *Elytra* similar to those of *A. olivaceus* but sides of upper surface more strongly and extensively depressed; striae less distinct, often obscured by scales or their punctures lacking associated granules (especially on disc between pale blotch and processes); interstrial granules more irregular and often larger than strial granules, especially in depressed areas (but absent from posterior part of disc); scales generally contiguous or subcontiguous but those composing pale discal blotch strongly imbricate and merging all round (except where produced anteriad along interstria 1) with dense or imbricate usually bright rust-brown scales which extend posteriad along interstriae 1–3 and on to process bases; between process bases and separating bright brown scales from pale declivital patch is a ± scale-free zone, glossy black on elytra proper and finely shagreened where it extends along inner sides of processes; setae on elytra proper of ♂ as in *A. olivaceus* but much larger in ♀, especially conspicuous around elytral apex where longest is as long as segment 2 of hind tarsi; setae in process fringes paler and somewhat shorter in ♀ than in ♂. *Mesepisterna*, etc., as in *A. olivaceus* except arms of mesosternum more extensively squamose. *Metasternum* with large round imbricate scales at sides, rapidly becoming much smaller, ovate and separate towards middle and on mesosternal process; venter almost entirely with such scales and with smaller, pointed, or even linear ones; setae fine, semi-erect and pale, those on ventrites 3 and 4 arranged in a single transverse row on each. *Legs* with femora strongly swollen; tibiae more strongly incurved towards apex in ♂ than in ♀, not sinuous; scales on swollen part of each femur contiguous or imbricate, ± concolorous with those on elytra but whitish and strongly imbricate below swelling and grading to pearly white on meso-dorsal aspect (especially on middle femora); setae mostly white, larger and, in general, more nearly erect in ♀ than in ♂. *Sexual dimorphism* strong; ♀ larger than ♂ and with larger clothing setae (see above); elytral processes of ♂ elongate, base conical, narrowly drawn out, flattened only towards apex and only there with a distinct edge; processes of ♀ as in *A. olivaceus* but usually sharper and with interstria 5 not raised in front of process; EPI 131–138 (♂), 114–120 (♀); ventrite 5 as in *A. olivaceus*; postero-ventral margin of prothorax of ♀ with a row of very long sub-erect setae (as long as width of a trochanter) and rims of pterygia smooth (cf. *cornutus*-group); rims of pterygia of ♂ microreticulate and prothorax without such setae.

Genitalia. Median lobe of aedeagus (Figs 220, 221) similar to that of *A. olivaceus* but slightly less elongate, ×0·6 as long as pronotum and ×2·9–3·3 as long as broad; struts ×1·8 as long as median lobe, manubrium shorter than median lobe, flagellum ×4·9–5·7 as long as median lobe and ×2·9–3·2 as long as pronotum (three observations). Spermatheca (Fig. 213) with body swollen and larger than tail; gland-lobe small; duct-lobe much shorter than body; gland claviform.

Holotype ♂, PAPUA NEW GUINEA: Eastern Highlands, Purosa, 1700 m, 17–25.v.1966 (*Gressitt & Tawi*), in BPBM.

Paratypes. PAPUA NEW GUINEA: 6 ♂, 2 ♀, same data as holotype (5 BPBM, 3 BMNH); 2 ♂, Purosa, 1700–2000 m, 18.i.1966 (*J. Sedlacek*); 1 ♂, Purosa, 20–26 km SE. of Okapa, 1800–2200 m, 28.viii.1964 (*J. & M. Sedlacek*); 1 ♀, Okapa, Okasa, 1400–1650 m, 16.i.1966 (*J. Sedlacek*); 1 ♂, 13 km SE. of Okapa, 1650–1870 m, 26.viii.1964 (*J. & M. Sedlacek*) (all BPBM); 1 ♂, 1 ♀, Okapa, 11.iv.1971 (*R. W. Hornabrook*) (RWH); 1 ♂, Okapa, *c.* 5000 ft [1500 m], 20.xii.1964 (*R. W. Hornabrook*), B.M. 1965–120 (BMNH); 2 ♂, 1 ♀, Kainantu, 1500 m, 20.i.1966 (*J. & M. Sedlacek*) (BPBM); 2 ♂, 1 ♀, Morobe District, Wau, Hospital Creek, 1200 m, i.1965 (*J. Sedlacek*) (2 BPBM, 1 BMNH); 2 ♂, ditto except 17.ii.1965 (*P. Shanahan*) (BPBM).

Specimens examined: 25; dissected: 6 (4 ♂, 2 ♀).

A very distinctive species with, apparently, a curiously disjunct distribution. Males outnumber females in the above series by >3 : 1.

Apirocalus (Apirocalus) olivaceus sp. n.

(Figs 3, 15, 214–216, 226–232; Map 6)

Range. Western, Southern and Eastern Highlands; Chimbu. Altitude: 2200–3900 m.

Length, ♂: 6·1–8·5 mm; ♀: 6·8–9·2 mm. Black or reddish black, antennae dark red (club black), legs dark red (coxae, knees and tarsi black); scales mainly either green, pearly or brown but dulled by contamination. *Head* with frons not, or only weakly declivous (often in line with rostrum in profile view), its surface marked with irregular rugae, radiating from the deep but narrow rostro-frontal furrow and continuing around eyes to underside of head; eyes strongly convex; scales contiguous (when large) or subcontiguous (when small), densest above and below eyes. *Rostrum* usually parallel-sided, rarely slightly widening apicad but often tapering; apex strongly and evenly rounded in dorsal view; upper surface weakly convex in profile view, merging with epistome and sloping more steeply apicad to a maximum of about 45° with horizontal plane of rostrum, evenly transversely convex throughout; median rostral carina variable, flanked by longitudinal rugae; scales and small white setae present on outer surface of pterygia, in front of eye and on dorsal surface posterior to level of antennal insertions. *Antennae* with funicle segments of equal width, 1 and 2 subequal and *c.* ×3 as long as broad, 3–7 subequal (in large specimens 3 is longest of the five, 4 next longest and 5–7 shorter and subequal), about half as long as 2 and ×1·3–2·1 as long as broad; club fusiform, ×2·6–3·4 as long as broad, stouter in small specimens and females; scape (Fig. 15) with upper surface finely punctured and very weakly rugulose; setae on both edges about equal in length to width of funicle segments, finely pointed, weakly to moderately curved, hyaline or brownish, often weakly iridescent; scales contiguous or separate, about half as large as those on pronotum. *Prothorax* slightly longer than broad in both sexes (rarely slightly broader than long), variable in shape, sides weakly to moderately rounded, sometimes with traces of a pre-apical constriction; disc of pronotum usually broadly depressed, the depression usually fairly well defined, centred on a point about one-third from base, surface usually with fine very irregular rugulae radiating from centre of depression and extending some way beyond it; centre of depression with very small, well defined but often mis-shapen shiny granules which grade peripherally into thickenings on the rugulae which are also exposed between the small, separate or subcontiguous scales; faint traces of a narrow median carina usually present, especially in anterior third and again near base. In some small specimens and some females, the pronotal depression is less well defined (or even absent), the rugulae do not radiate and the granules are larger. Scales at sides of prothorax twice as large as those on disc, dense throughout; setae very small, brown and inconspicuous. *Elytra* ovate, ×1·1–1·3 as long as broad, sides strongly rounded, disc flat or weakly convex in profile view, declivity steep in ♀, subvertical in ♂; surface of disc uneven, area behind shoulder region (interstriae 5 and 6) flattened or depressed, adjacent area (centred on interstria 3) raised (especially in ♂); striae narrowly scale-free on disc and declivity; strial punctures with distinct associated granules, as in *A. avus*; interstriae with a single widely spaced row of smaller granules (scale-size or smaller); striae 2 and 3 usually diverge posteriorly and 1 runs parallel to 2, so that 1 often approaches suture at top of declivity (Fig. 3); scales contiguous or imbricate over greater part of elytra, strongly imbricate (and often paler) along costal margin and on declivity, separate on processes, often with a dull brown band across top of declivity (as in *A. granulicollis*) which contrasts sharply with scales on declivity when these are pale; setae generally small and inconspicuous but larger around apex, those in process fringes mainly red-brown, grading to pearly anteriorly, the longest as long as greatest diameter of hind femur (viewed from above). *Mesepisterna* with a few small scattered punctures, surface uneven, extensively covered with scales which are mostly similar to those on adjacent part of elytra but thin out and become smaller anteriorly, also with a few stiff but recumbent setae; arms of mesosternum with surface even and microreticulate with few, if any, punctures, few, if any, scales and no setae. *Metasternum* densely squamose throughout; ventrite 1 similar anteriorly, scales becoming smaller and sparser posteriorly, very small and scattered on ventrites 3–5; setae fine, semi-erect throughout, forming a single irregular transverse row on ventrites 3 and 4. *Legs* with femora moderately swollen; fore and middle tibiae weakly incurved towards apex, hind tibiae very weakly incurved, fore and hind tibiae often very weakly sinuous; hind tarsal claw-segment usually ×2·1–2·3 as long as segment 3; scales about as large as those on disc of pronotum, often coppery (sometimes with blue or violet reflexions), contrasting strongly with those on elytra, usually separate or subcontiguous but sometimes contiguous on widest part of femora and along outer (dorsal) aspect of tibiae; hind tarsal segment 2 occasionally with a few very small scales; setae larger, on average, than those on scape, weakly curved, pointed, mainly whitish,

between subrecumbent and semi-erect, those on knees arising from distinct granules. *Sexual dimorphism* well marked; elytral processes of ♂ elongate, flattened, with distinct outer edge, strongly diverging and often steeply rising or curving upwards; spread of processes exceeding greatest width of elytra proper; process bases narrower than this; inner margins of processes arising from stria 2, ± straight, angle between them varying from distinctly less than a right angle to distinctly more than a right angle (in antero-dorsal view); processes of ♀ similar to those of *A. avus* (♀) but usually somewhat flattened towards apex and with their inner margins sometimes only making a right angle with each other, outer margins ± continuous with interstria 5, which is often raised anteriad as far as level of hind coxae; EPI 118–134 (♂), 107–123 (♀); ventrite 5 variably foveate in both sexes (sometimes with two distinct longitudinal carinae), posterior margin reflexed ventrad in ♀, making fovea appear larger; rostrum with rims of pterygia microreticulate in ♂, smooth in ♀ but ♀ without large setae along postero-ventral margin of prothorax (cf. *A. stellifer*).

Genitalia. Median lobe of aedeagus (Figs 226–232) ×0·6–0·9 as long as pronotum, ×3·2–4·2 as long as broad, strongly curved towards base, narrowed towards apex which is strongly compressed, forming a thin plate which is reflexed dorsad so that its plane is ± in line with lower side of base; struts ×1·2–2·3 as long as median lobe, manubrium ×0·6–0·9 as long as median lobe, flagellum ×2·6–4·4 as long and ×1·8–3·0 as long as pronotum, strongly curved in basal part but not usually forming a ring. Spermatheca (Figs 214–216) linear, tail as large as or larger than body; gland-lobe distinct, its axis usually subparallel with that of body; duct-lobe about as long as body, about as wide as gland-lobe at base, weakly tapering distad, weakly curved, sinuous or (rarely) sigmoid; duct several times overall length of spermatheca; spout straight, unpigmented.

Holotype ♂, Papua New Guinea: Chimbu, Asaro-Chimbu Divide, Marifuanga, 25.iv.1972 (*R. W. Hornabrook*), in BMNH.

Paratypes. Papua New Guinea: 5 ♂, 6 ♀, same data as holotype (7 RWH, 4 BMNH); 4 ♂, 5 ♀, ditto except 23.x.1971 (7 RWH, 2 BMNH); 1 ♂, 1 ♀, ditto except iv.1971 (BMNH); 3 ♂, 2 ♀, Asaro-Chimbu Divide, Daulo Pass, 2500, 2800 and 3000 m, 12, 13 and 14.vi.1955 (*J. L. Gressitt*); 1 ♂, 1 ♀, Daulo Pass, 2400 m, 15.v and 7.vii.1963 (*J. Sedlacek*) (all BPBM); 1 ♂, Daulo Pass, iii.1971 (*R. W. Hornabrook*) (RWH); 1 ♂, 1 ♀, ditto except 21.vi.1975 (RWH, BMNH); 1 ♂, Asaro valley, Miramar-Gobavabe, 2000 m, 29.vi.1955; 1 ♂, Upper Chimbu-Kerowagi Divide, 2500 m, 6.vii.1955 (both *J. L. Gressitt*) (both BPBM); 1 ♀, Mt Wilhelm, Pengal River, 9200 ft [2760 m], 16.v–9.vi.1963 (*W. W. Brandt*) (ANIC); 4 ♂, 2 ♀, Mt Wilhelm, 2600–3000 m, 2 and 6.vii.1963 (*J. Sedlacek*); 3 ♂, 2 ♀, Mt Wilhelm, 25[00]–3000 m, 20.v, 30.vi and 4.vii.1966 (*J. L. Gressitt*) (all BPBM); 3 ♂, 1 ♀, Mt Wilhelm, 3900 m, 13–24.ix.1968 (*J. Balogh*) (TM); 1 ♂, Mt Wilhelm, *c.* 8000 ft [2400 m], Station No. 194, 20–23.ii.1965 (*M. E. Bacchus*) (BMNH); 2 ♂, Mt Wilhelm, east slopes, No. 6 Pengagl Camp, 2770 m, 6–7.vii.1959 (*L. J. Brass*), Sixth Archbold Exp. (AMNH); 2 ♂, 2 ♀, Mt Wilhelm, Keglsugl, 10–14.viii.1969 (*J. Balogh*) (TM); 1 ♂, 1 ♀, Keglsugl, 2750 m, 17.v.1966 (*J. L. Gressitt*); 1 ♂, Keglsugl, 2500–2720 m, 1.vii.1963 (*J. Sedlacek*); 2 ♂, Mt Wilhelm, Lake Aunde, 2500 m, vii.1968 (*R. Rice*); 2 ♂, 1 ♀, above Kerowagi, 2300 m, 6.vii.1955 (*J. L. Gressitt*) (all BPBM); 5 ♂, 3 ♀, Western Highlands, Nondugl, 16.xi.1950 [*W. W. Brandt*] (ANIC); 3 ♂, 4 ♀, Lake Sirunki, 2800–2900 and 2550 m, 15 and 17.vi.1963; 1 ♂, 1 ♀, Kepilam, 2420–2540 m, 21.vi.1963 (all *J. Sedlacek*) (all BPBM); 2 ♂, 2 ♀, Southern Highlands, Mt Giluwe, 2550 and 2500 m, 27.v and 6.vi.1963 (*J. Sedlacek*) (2 BPBM, 2 BMNH); 3 ♀, SE. of Mt Giluwe, Dimifa, 2200 m, 10.x.1958 (*J. L. Gressitt*) (2 BPBM, 1 BMNH); 1 ♂, Eastern Highlands, Mt Michael, 2200–2500 m, 20.i.1966 (*J. Sedlacek*) (BPBM); 1 ♀, Okapa, Kamano, 28.i.1973 (*R. W. Hornabrook*) (RWH).

Specimens examined: 92; dissected: 26 (15 ♂, 11 ♀).

A widespread and variable species which reaches higher altitudes than any other in the genus. Specimens from the westernmost localities (Mt Giluwe, Kepilam) are often below average size, have much larger granules on the pronotum and larger scales, even in absolute terms (notwithstanding their smaller body-size) than specimens from the other localities; the median lobe of the aedeagus is shorter in relation to the pronotum while the struts are longer. Although there are females of normal size from these localities, only small males are known from them, so that the significance of the genitalic differences cannot be properly assessed. For this reason, and because the specimens from nearby Lake Sirunki appear to be intermediate, I have refrained from assigning the western specimens to a distinct subspecies. A record for Lake Kutubu (RWH) requires confirmation.

Apirocalus (Apirocalus) tenebricosus sp. n.

(Figs 217, 222–225; Map 6)

Range. Eastern Highlands. Altitude: 1800–2200 m.

Length 7·8–8·6 mm. Differs from *A. olivaceus* as follows. Scales in ♂ much smaller, round or ovate, grey, green, pearly or coppery (with strong blue reflexion), well separated and not imparting any colour to body, which appears dull black to unaided eye; scales in ♀ larger, sometimes as large as in *A. olivaceus* but in mixture of mostly dull colours, usually grey-green or grey-brown, denser and paler on elytral declivity. *Sexual dimorphism* less strong; elytral processes situated slightly further forward, those of ♂ shorter, straighter and steeper, those of ♀ slightly shorter; EPI 107–121 (♂), 105–114 (♀).

Genitalia. Median lobe of aedeagus characteristic (Figs 222–225), at least as long as pronotum; struts as long as pronotum, flagellum × 2·3–2·6 as long (three observations). Spermatheca (Fig. 217) resembles that of *A. olivaceus.*

Holotype ♂, Papua New Guinea: Eastern Highlands, Mt Otto, 7.ix.1972 (*R. W. Hornabrook*), in BMNH.

Paratypes. Papua New Guinea: 2 ♂, 2 ♀, same data as holotype (3 RWH, 1 BMNH); 1 ♂, ditto except 30.v.197– (RWH); 2 ♂, 1 ♀, south slopes of Mt Otto, Kotuni, No. 7, 2200 m, 9 and 16–19.viii.1959 (*L. J. Brass*), Sixth Archbold Exp. (AMNH); 1 ♂, Asaro valley, Miramar, 1800 m, 27.vi.1955 (*J. L. Gressitt*) (BPBM).

Specimens examined: 10; dissected: 4 (3 ♂, 1 ♀).

Closely related to *A. olivaceus* (females are scarcely separable). The Miramar specimen has steeper elytral processes than the other males and its aedeagus is longer.

Apirocalus (Apirocalus) anatinus sp. n.

(Figs 218, 219, 238; Map 6)

Range. Eastern Highlands. Altitude: 1800 m.

♂. Length 8·5 mm. Differs from *A. olivaceus* as follows. *Antennae* with funicle segment 2 distinctly longer and slightly narrower than 1 (× 4 as long as broad); scape claviform, very slender in basal two-thirds (about as wide as funicle), thickening rather abruptly in distal third; longest setae on leading edge slightly longer than width of funicle and also exceeding greatest diameter of scape in middle of length. *Prothorax* with a section of well developed median carina in anterior third of pronotum and traces of a carina in posterior two-thirds. *Elytra* with processes triangular (apex rounded), plane in line with middle coxa, inner (posterior) margin broadly rounded, vertical, outer margin with sharp edge; processes diverging by about a right angle (in posterior view) and set about mid-way between base and apex of elytra; setae in apical fringes shorter than in *A. olivaceus*, almost all red-brown; declivity elongate, tapering, sloping at about 45° to horizontal; pre-apical callus (at confluence of interstriae 3 and 9) prominent (small or obsolete in *A. olivaceus*); EPI 100.

Genitalia. Median lobe of aedeagus characteristic (Figs 218, 219), × 1·5 as long as pronotum, struts × 0·6 as long as median lobe and × 0·9 as long as pronotum; flagellum × 2·5 as long as pronotum.

Holotype ♂, Papua New Guinea: Eastern Highlands, Aiyura, 6000 ft [1800 m], 11.vii.1962 (*J. H. Barrett*), in BMNH.

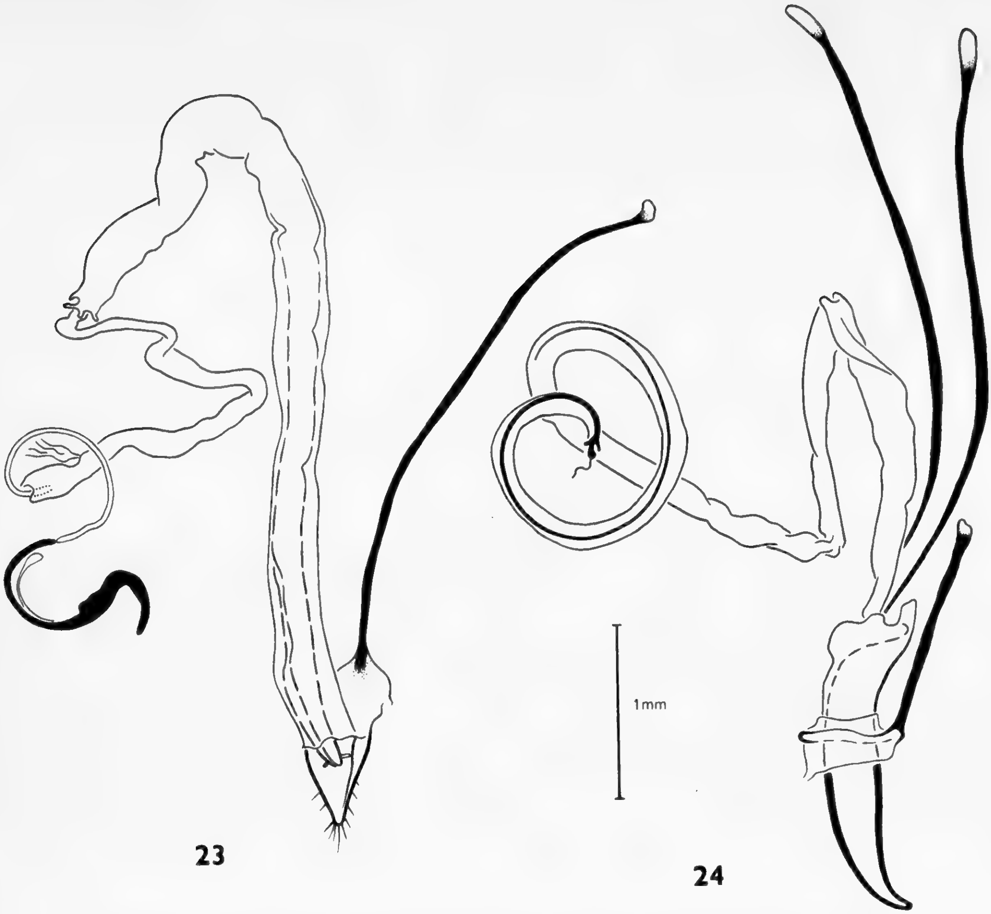
Bionomic data. 'x moss x forest'.

A very distinctive species which also has the longest known aedeagus in the genus and the only one that is longer than its struts. The name derives from a fancied resemblance of the specimen to a duck in flight.

ALBERTISIUS gen. n.

Type-species: *Apirocalus gestroi* Pascoe (Fig. 242).

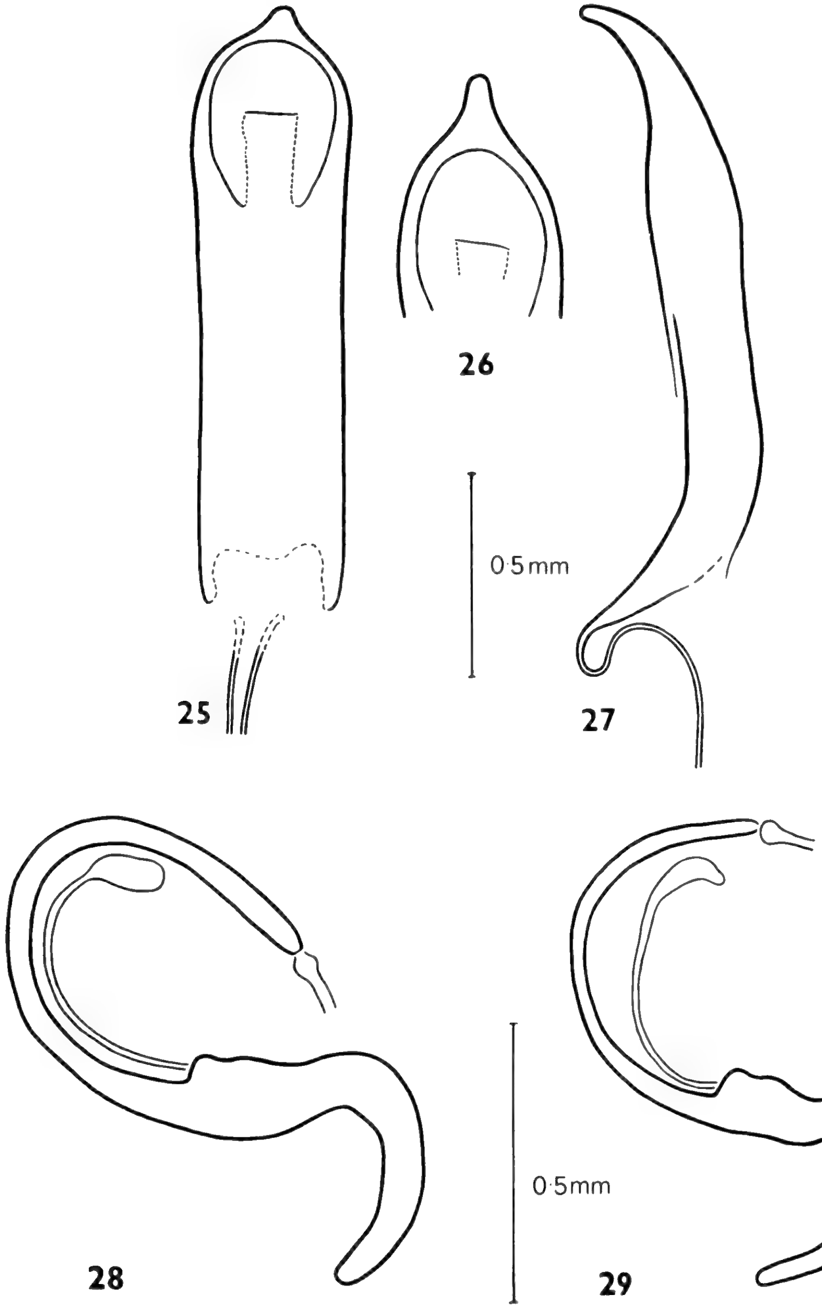
Celeuthetine Curculionidae (*sensu* Marshall, 1956 : 5) with head constricted behind eyes; eyes strongly convex, undercut on dorsal and posterior aspects and projecting slightly over post-ocular constriction. Rostrum strongly widening at pterygia; dorsal surface explanate above antennal insertions, strongly



Figs 23, 24 *Albertisius* species, genitalia. 23, *excellens* ♀; 24, *gestroi* ♂.

narrowing towards middle, thence evenly widening to base; width above antennal insertions equal to, or greater than width at base and width of frons between eyes; apical region weakly and smoothly or strongly and rather abruptly declivous; mentum with two setae. Frons separated from rostrum by a deep V-shaped furrow, the two limbs of which are almost separated by narrow tip of otherwise broad and flat (fusiform) median rostral carina. Antennal scape about as long as pronotum, slender, terete, widening gradually from base, densely squamose; funicle segments with recumbent silky hairs but no scales; segments 1 and 2 subequal. Prothorax slightly longer than broad, apex distinctly narrower than base, convexity along mid-line very similar to that at sides; almost entire surface covered with large deep close-set punctures whose interspaces form a fairly regular reticulum, usually without granules. Scutellum absent. Base of elytra sharp and slightly raised; 10 striae, 10 approached by 9 at level of hind coxae and thence very tenuous; sides (interstriae 5–6) produced horizontally and laterad to form a carina or process fringed with setae. Fore coxae narrowly separated, partly squamose; middle coxae with or without scales; trochanters without a single large seta; tarsi with recumbent lanceolate setae but no true scales. Intercoxal process of mesosternum about as long as broad; arms of mesosternum and mesepisterna squamose. Ventrites 3 and 4 squamose; ventrite 5 weakly foveate in both sexes; hidn tibiae of ♂ swollen or not.

Genitalia (Figs 23–29) similar to those of *Apirocalus* except aedeagal struts of ♂ with strong S-shaped flexure at base (Fig. 27) and spermatheca of ♀ with duct-lobe much longer (× 3 as long as body of spermatheca) and strongly recurved 'dorsad' (Figs 28, 29); flagellum of ♂ short and less strongly tapering than those of comparable length in *Apirocalus*; short section of internal sac near anterior end lined with very dense sharp weakly pigmented denticles.



Figs 25–29 *Albertisius* species, genitalia. Aedeagus of *A. gestroi* in (25) dorsal, (26) postero-dorsal and (27) right lateral view. 28, 29, spermathecae of *A. excellens*.

Albertisius differs from *Heteroglymma* (Celebes) in having only ten elytral striae; from *Apirocalus* and *Kokodanus* in having only two setae on the mentum and the rostrum at least as wide above antennal insertions as frons between eyes; from *Hellerrhinus* in having a post-ocular constriction and strongly punctured prothorax; from *Peteinus* (Misima I.) in having only two setae on the mentum and the pronotum punctate, not granulate. Its closest relative appears to be *Cyphopus* which also has two setae on the mentum, a strongly punctured pronotum and sometimes broad lateral elytral processes. *Cyphopus* differs from *Albertisius*, however, in having a stouter scape, the prothorax almost as wide at apex as at base (Marshall, 1956 : fig. 43), the rostro-frontal furrow weakly curved instead of sharply angulate and the two anterior pairs of femora deformed.

Congeneric with *A. gestroi* is *Idiopsis excellens* Faust (Marshall, 1956 : fig. 32); both species agree closely in the structure of the head, rostrum and antennae, shape and sculpture of the prothorax and in the male genitalia. They both have a pair of broad elytral processes which are horizontal and arise from the sides of the elytra rather than from the declivity, as in *Apirocalus*. The apex of the rostrum dorsally is weakly declivous in *A. gestroi* but more strongly and sometimes rather abruptly so in *A. excellens* (Faust) **comb. n.** The two species therefore separate at the first couplet in Marshall's key (1956 : 9); neither will run out in it.

I here propose *Idiopsodes* **nom. n.** for *Idiopsis* Faust, 1897 *nec* Brauer & Bergenstamm, 1889 (Diptera).

Albertisius excellens (Faust) differs from *Idiopsodes griseus* (Faust) **comb. n.** (type-species of *Idiopsodes*) in having more strongly convex, posteriorly undercut eyes, a deeper rostro-frontal furrow, a distinct median rostral carina and a wider rostral apex. In *I. griseus*, the dorsal surface of the rostrum is uneven, often with a narrow median furrow but no carina; it is narrower above the antennal insertions than it is at base; the mentum has several small setae in addition to the two principal ones; the elytra are subglobose, with no trace of processes or tubercles; striae 9 and 10 are similar and roughly equidistant throughout their length.

The two species of *Albertisius* may be distinguished thus:

1 Elytral processes truncate (♂) or acuminate (♀) and confined to middle third of elytra. Hind tibiae of ♂ unmodified. Scales green, uniformly distributed. Length 6·0–8·5 mm. Apex of median lobe of aedeagus broadly rounded, without any median projection. (Central District, around Port Moresby) ***excellens*** **(Faust)**

– Elytral processes cariniform, extending into posterior third of elytra (♂). Hind tibiae of ♂ swollen and with dense stiff setae. Scales white, forming a pattern (Fig. 242). Length 7·0–9·2 mm. Apex of median lobe of aedeagus mucronate (Fig. 26). (Central District, Yule I.) . ***gestroi*** **(Pascoe)**

It is a very odd fact that all 26 specimens of *A. gestroi* that I have examined (7 MNHN, 6 BMNH, 6 SMT, 6 IP, 1 NMNH) are males; there are a further 27 specimens in the Genoa Museum (von Hayek, pers. comm.) so perhaps a female will be found among these. With a few possible exceptions, all the specimens were taken on Yule I. in May 1875 by the intrepid Italian explorer, L. M. D'Albertis. The exceptions are four specimens from Faust's collection (SMT) labelled 'N. Guinea / Doria' (Faust MS) and a specimen from the Bovie collection (NMNH) labelled 'Nov. Guinée'; 'Heller' (Bovie MS). The record published by Voss (1958 : 209) of specimens from Yule I. taken by L. Biró between 1897 and 1900 refers to *Apirocalus cornutus*. Whether all the known specimens of *A. gestroi* were collected by D'Albertis, or not, the fact remains that I have seen no other definite records of this species. This situation contrasts with that of *Apirocalus cornutus*; D'Albertis took over 250 specimens on Yule I. in April–June 1875 but, unlike *A. gestroi*, it has been recorded there subsequently, both in 1933 and in 1974.

Albertisius gestroi was transferred from *Apirocalus* to *Heteroglymma* by Marshall in 1938 (: 96) but returned by him to *Apirocalus* (without comment) in 1956 (: 17).

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Material totalling some 6430 specimens was assembled for study. Apart from small but valuable collections made by Miss L. E. Cheesman (1934) and M. E. Bacchus (1964), almost the whole of

this material was obtained on loan from the institutions listed on p. 193 through the kindness of their curators: Dr Lee H. Herman, Jr (AMNH); Dr E. B. Britton (ANIC); Dr J. L. Gressitt (BPBM); Hugh B. Leech (CAS); Rhonda M. Stevens and Dr J. N. L. Stibick (DAPM); Dr B. Gray (DFB); Louise A. Bernard (FMNH); Dr L. Dieckmann (IP); Janice C. Scott (MCZ); Dr G. Scherer (MGF); Melle H. Perrin (MNHN); Rose E. Warner (NMNH); Helen Malcolm (NMV); J. Krikken (RNH); Dr E. G. Matthews (SAM); Dr R. Hertel (SMT); Dr S. Endrödi (TM).

I am especially grateful to Mrs P. Vaurie who searched for material at both AMNH and MNHN; to my colleague, Christine von Hayek, who investigated the collection of the Genoa Museum on my behalf and to my former colleague, Brian Levey, who discovered the Cape York specimens of *A. cornutus* in NMV. I also wish to thank Professor Vasco M. Tanner of Brigham Young University, Utah, for passing on to me 183 specimens from BPBM which he had intended to study himself.

The importance of accurate locality-data in the study of flightless insects cannot be overemphasized (Thompson, 1968 : 360). In a mountainous country like New Guinea, altitude is also important. In this study, I was fortunate to have on loan material from the vast collection assembled at BPBM by Dr J. L. Gressitt; each specimen bears printed data-labels which include precise locality and altitude. Such material is a joy to work with and has formed the basis of this revision. Useful bionomic data were obtained from the extensive collection of DAPM and that of DFB.

A major contribution to this study was made by Dr R. W. Hornabrook, former Director, Papua New Guinea Institute of Medical Research, Goroka, whose enthusiastic collecting has produced several new species.

Help in tracing localities was given by Dr E. C. Zimmerman (ANIC), Dr J. J. H. Szent-Ivany (*ex*-DAPM), Dr J. N. L. Stibick (DAPM), Frau R. Kadlec (MGF) and Dr R. W. Hornabrook.

Information on parasites was provided by my colleagues, K. G. V. Smith (Diptera), Dr Z. Bouček (Commonwealth Institute of Entomology) (Hymenoptera) and J. MacFarlane (CIE) (Acarina). A pollen sample was identified by my colleague, Dr G. C. S. Clarke.

I owe a special debt of gratitude to Dr W. A. Sands of the Centre for Overseas Pest Research for the use of equipment for recording automatically on punched tape the measurements for Fig. 22. The data-processing for this figure was carried out by my colleagues Dr M. Hills and Miss K. Shaw.

The key was tested by Dr M. Cox (CIE) and by my assistant, Miss S. J. Reddick, who revealed several important weaknesses in the original draft. I wish to thank my senior colleague, R. D. Pope, for reading the manuscript and suggesting several significant improvements. I also thank Dr G. A. Samuelson for providing copies of the BPBM map of New Guinea and Dr F. J. Radovsky, Chairman, Department of Entomology, BPBM, for permission to reproduce them here.

The photographs of whole specimens were prepared by the BMNH photographic unit.

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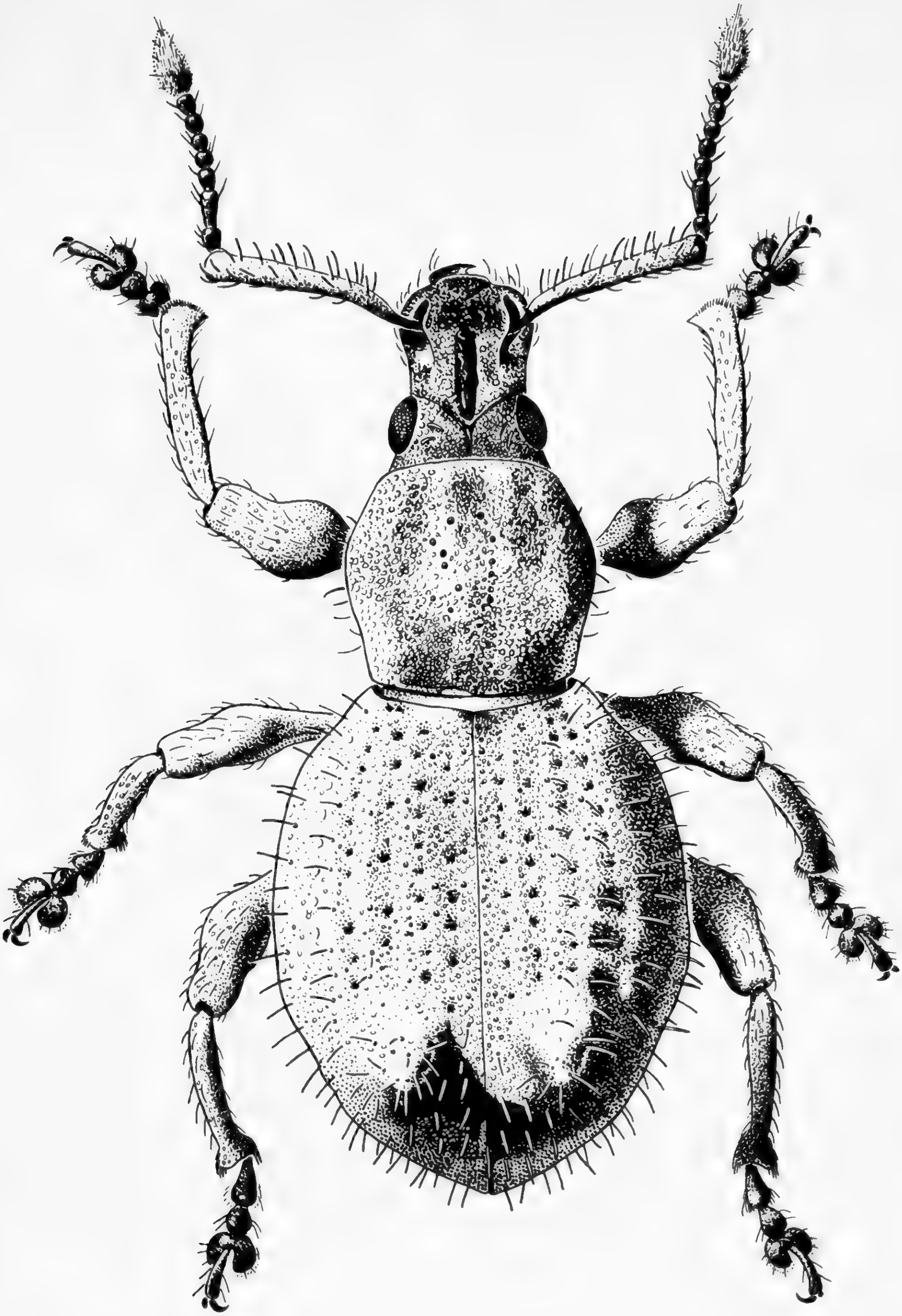
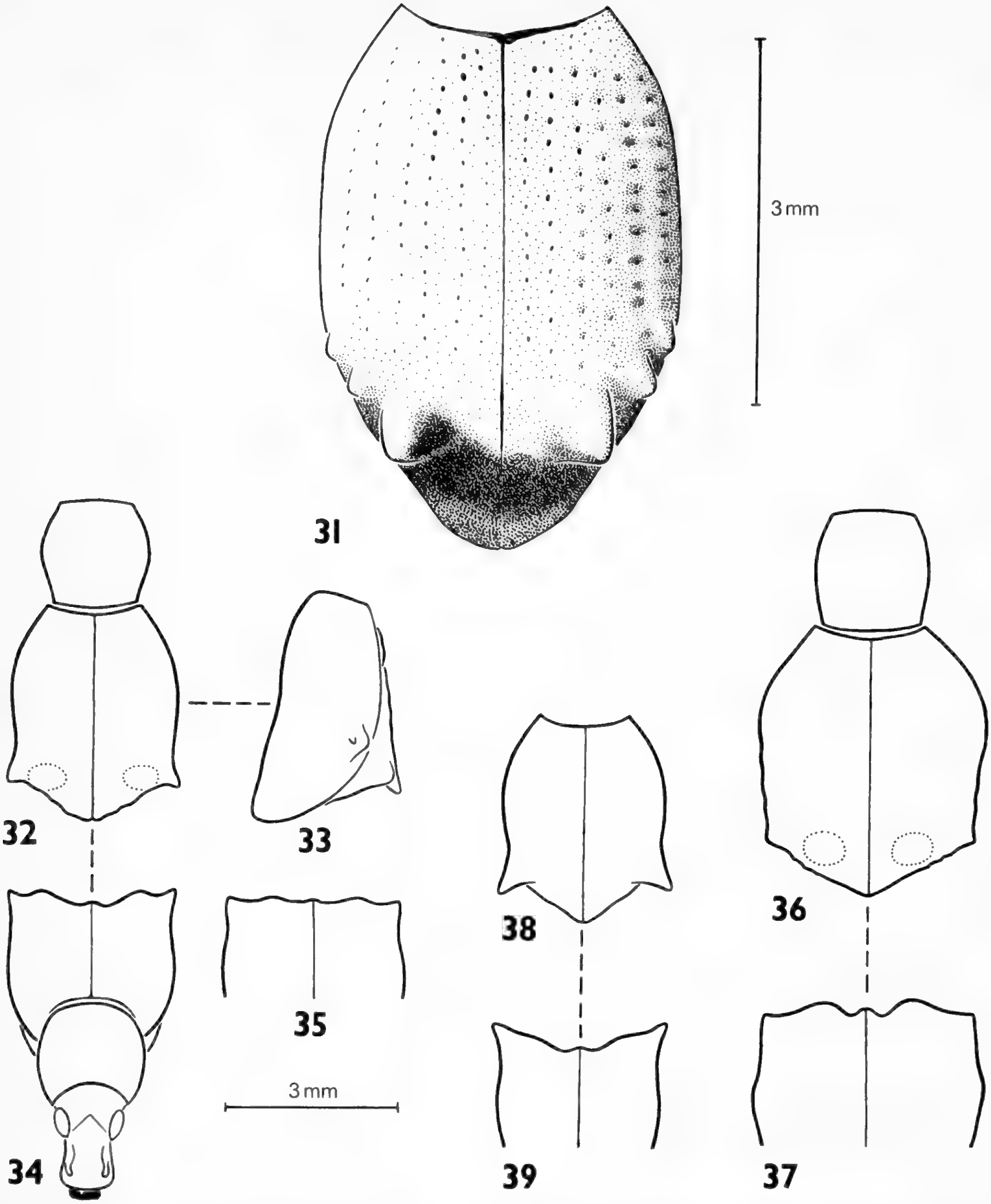


Fig. 30 *Apirocalus (Molobrium) io.*



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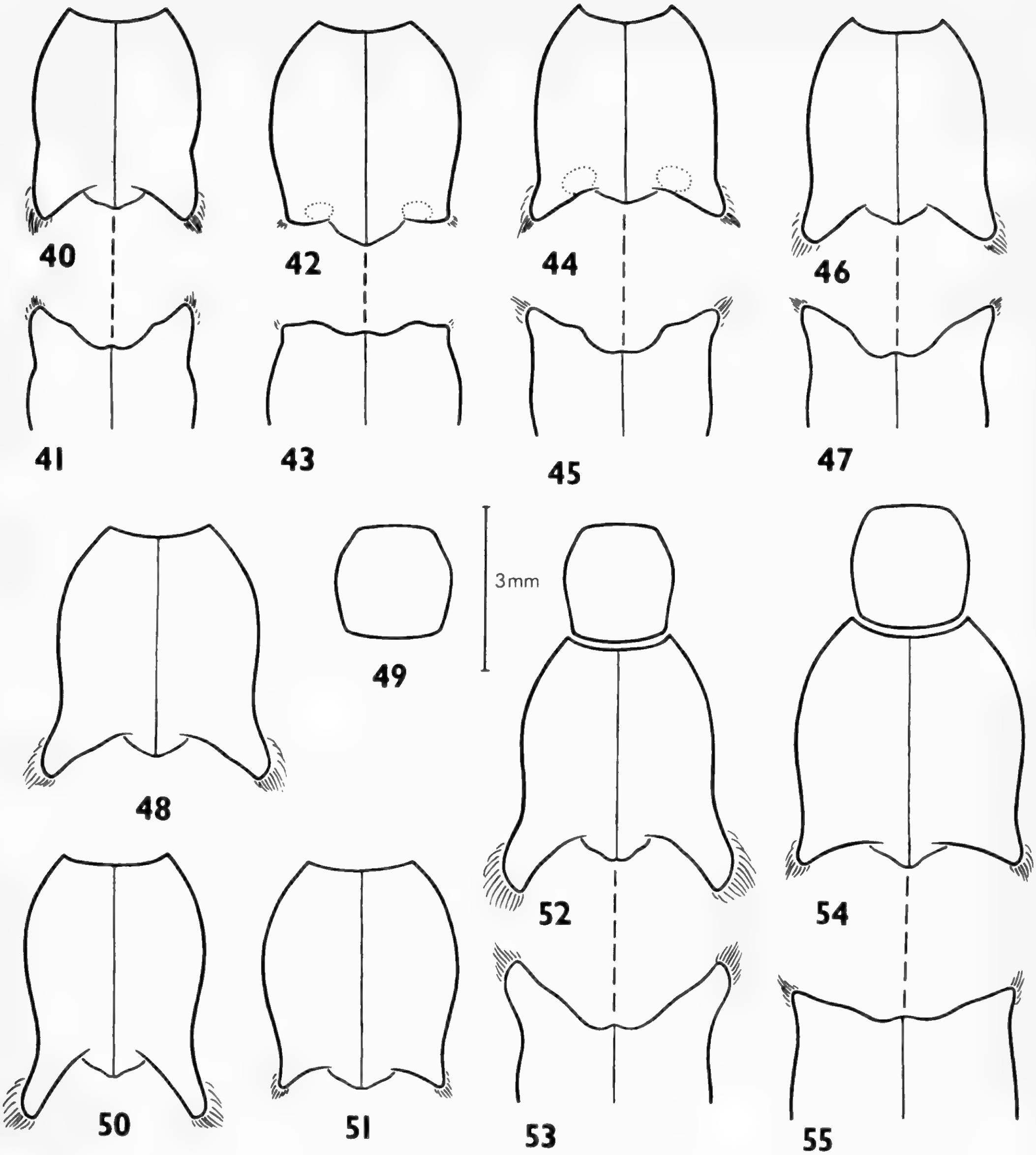
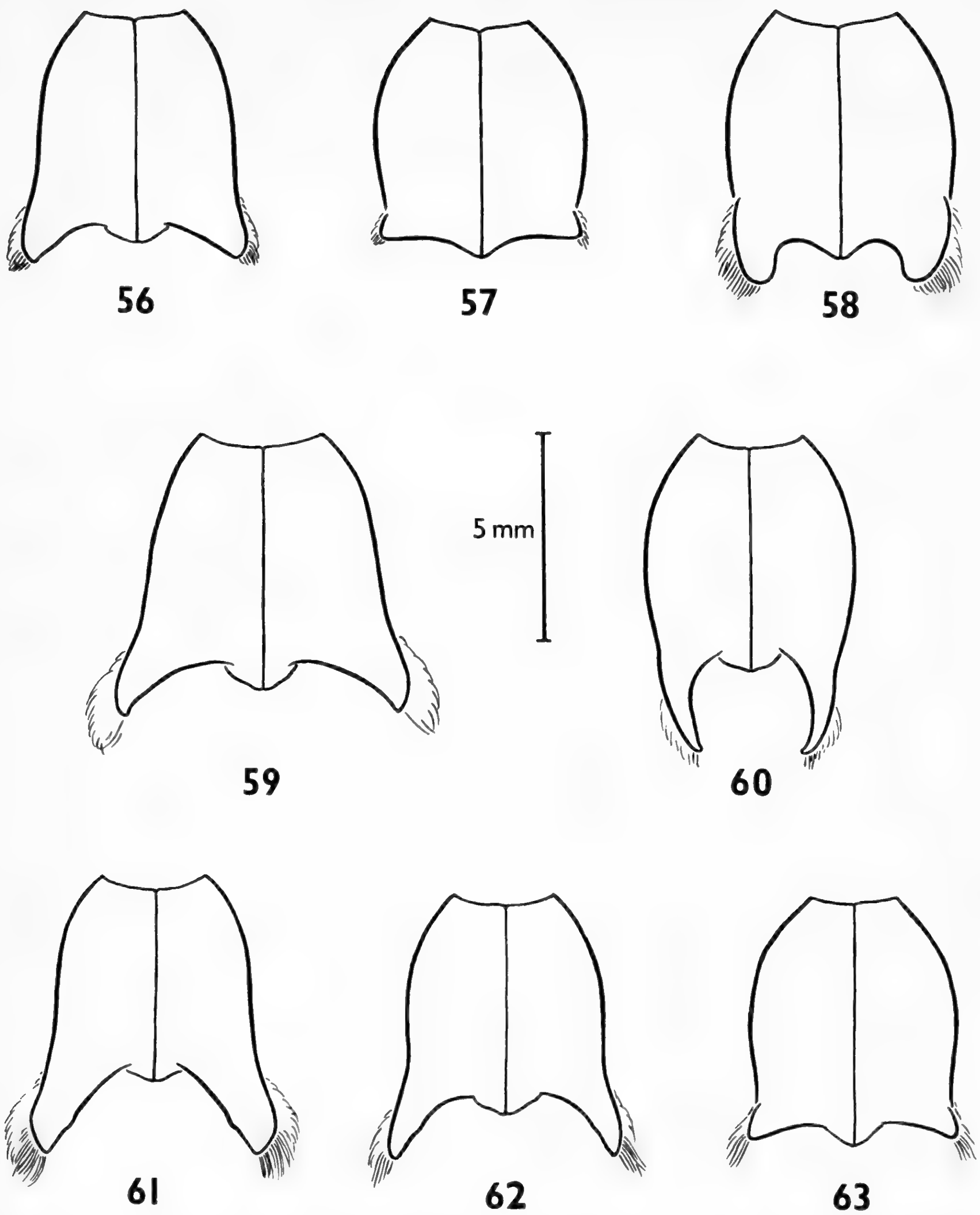


Figs 40–55 *Apirocalus* (*A.*) *avus*-group, outlines. Elytra in dorsal and antero-dorsal view (cf. Figs 32 and 34) of (40, 41) *subcostatus* ♂, (42, 43) *idem*, ♀, (44, 45) *suppuratus* ♂, (46, 47) *avus intermedius* ♂ (holotype). 48, elytra of *a. finisterrae* ♀ (Wantoat). 49, prothorax of *sedlaceki* ♂. 50, elytra of *a. marawakanus* ♂; 51, *idem*, ♀. 52, 53, prothorax and elytra in dorsal view and elytra in antero-dorsal view of *a. avus* ♂; 54, 55, *idem*, ♀.



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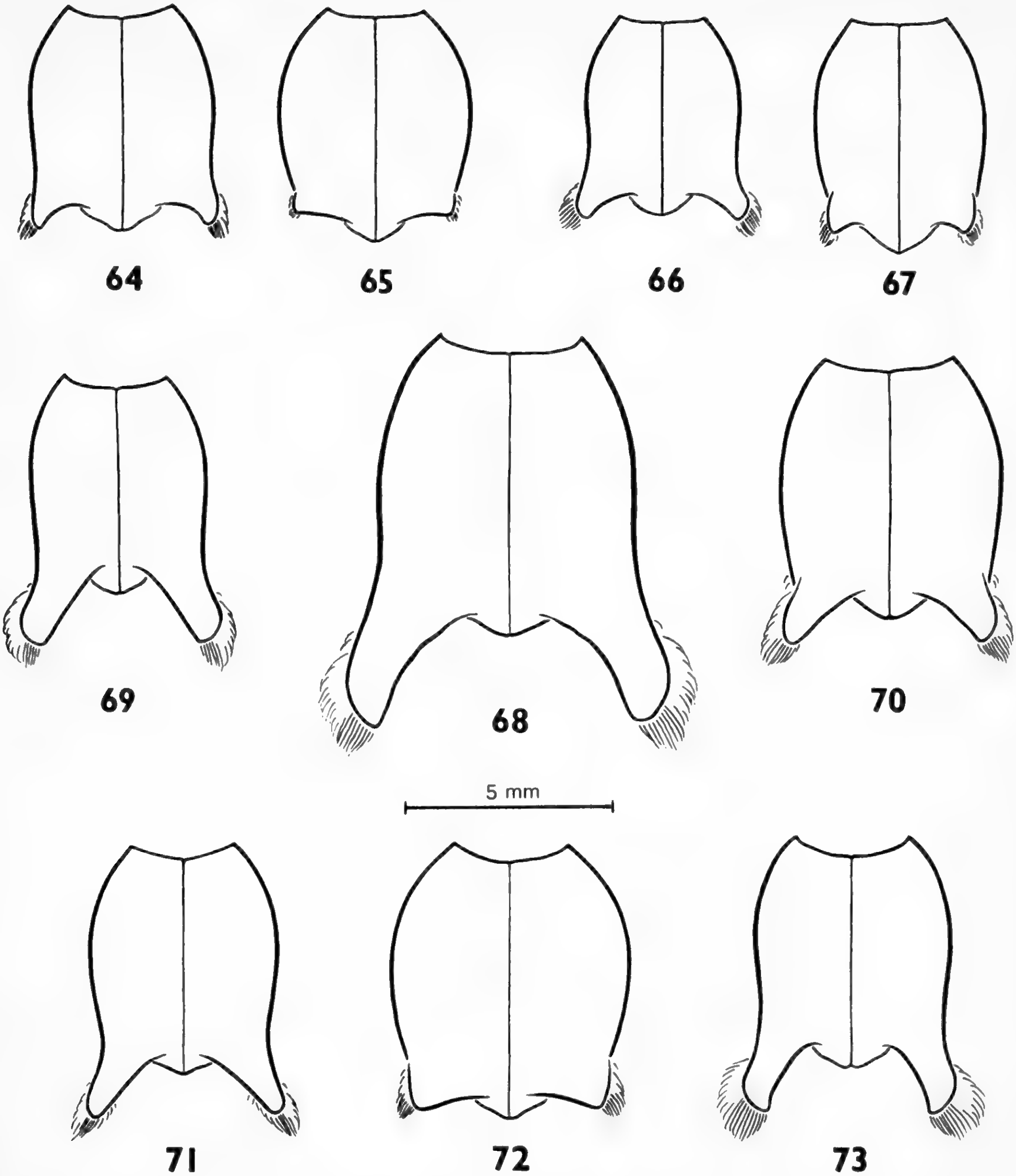

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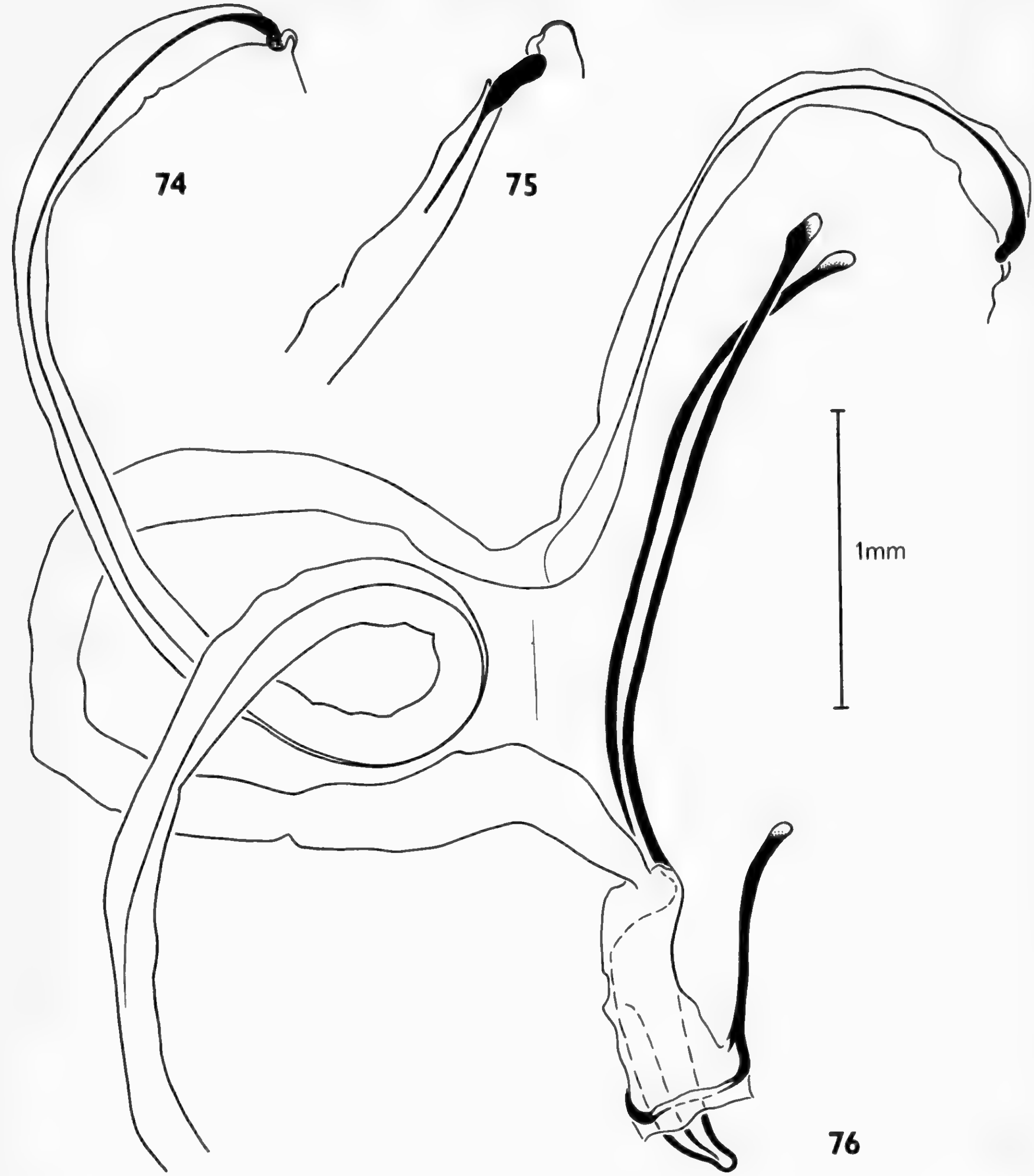

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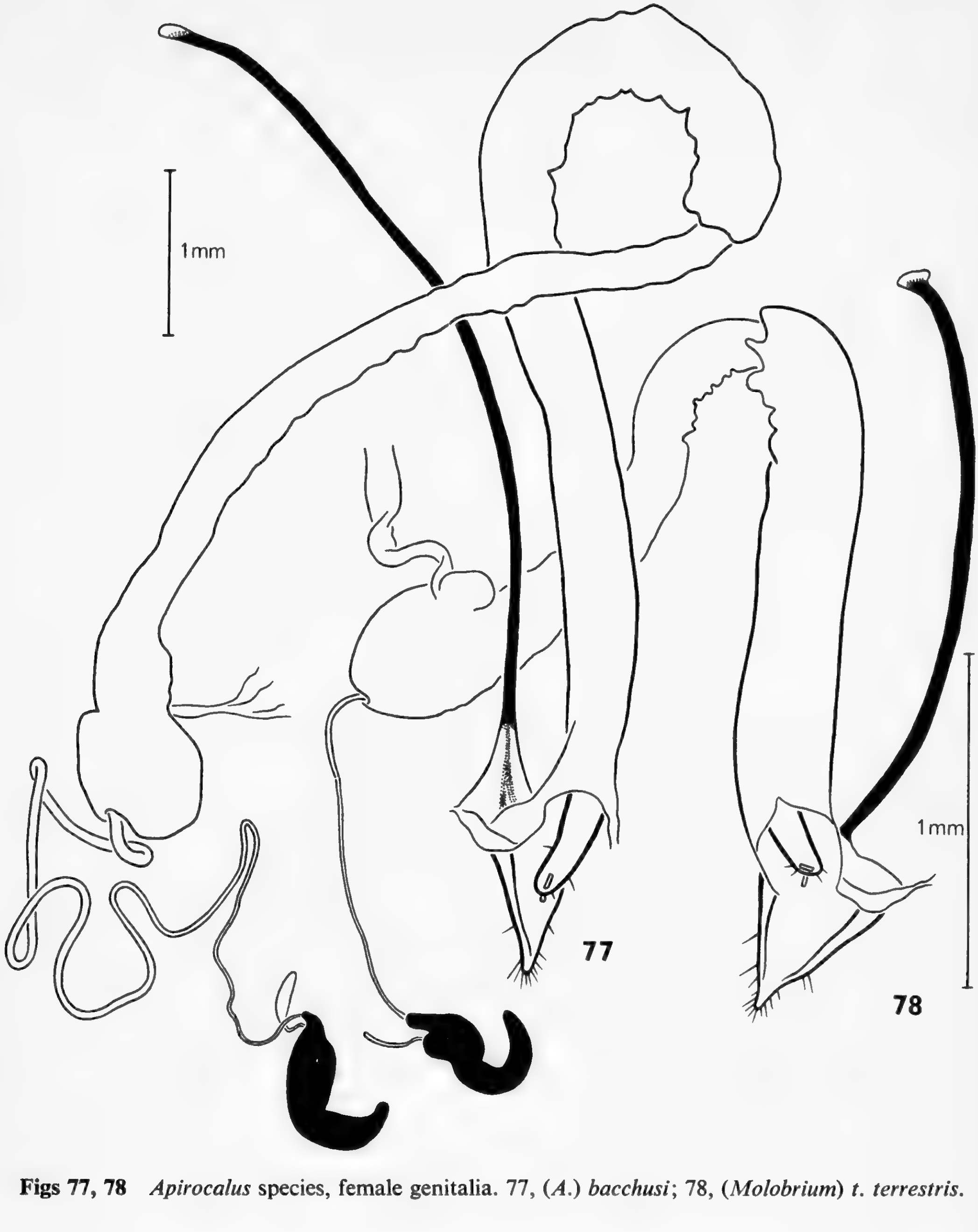
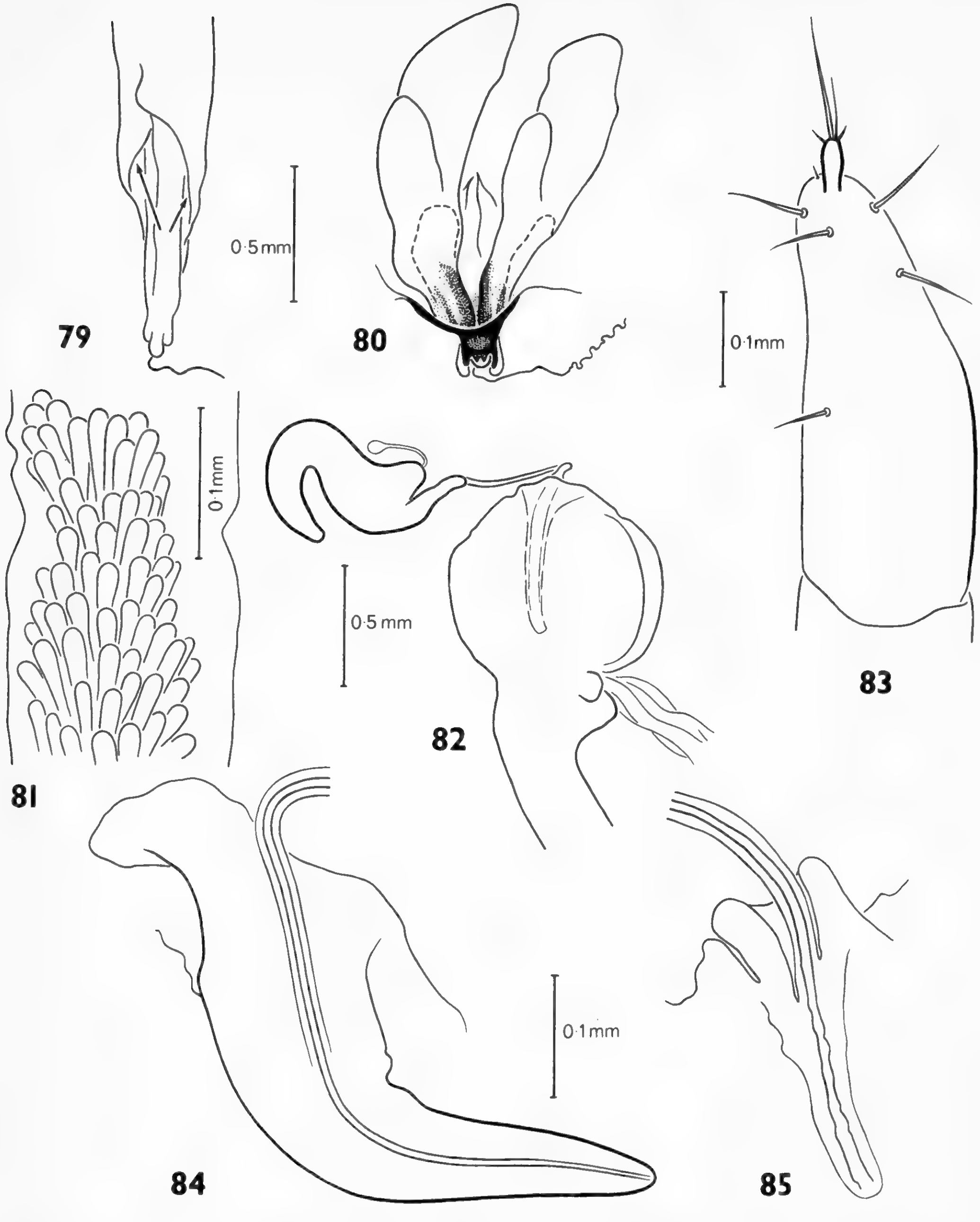


Figs 77, 78 *Apirocalus* species, female genitalia. 77, (*A.*) *bacchusi*; 78, (*Molobrium*) *t. terrestris*.



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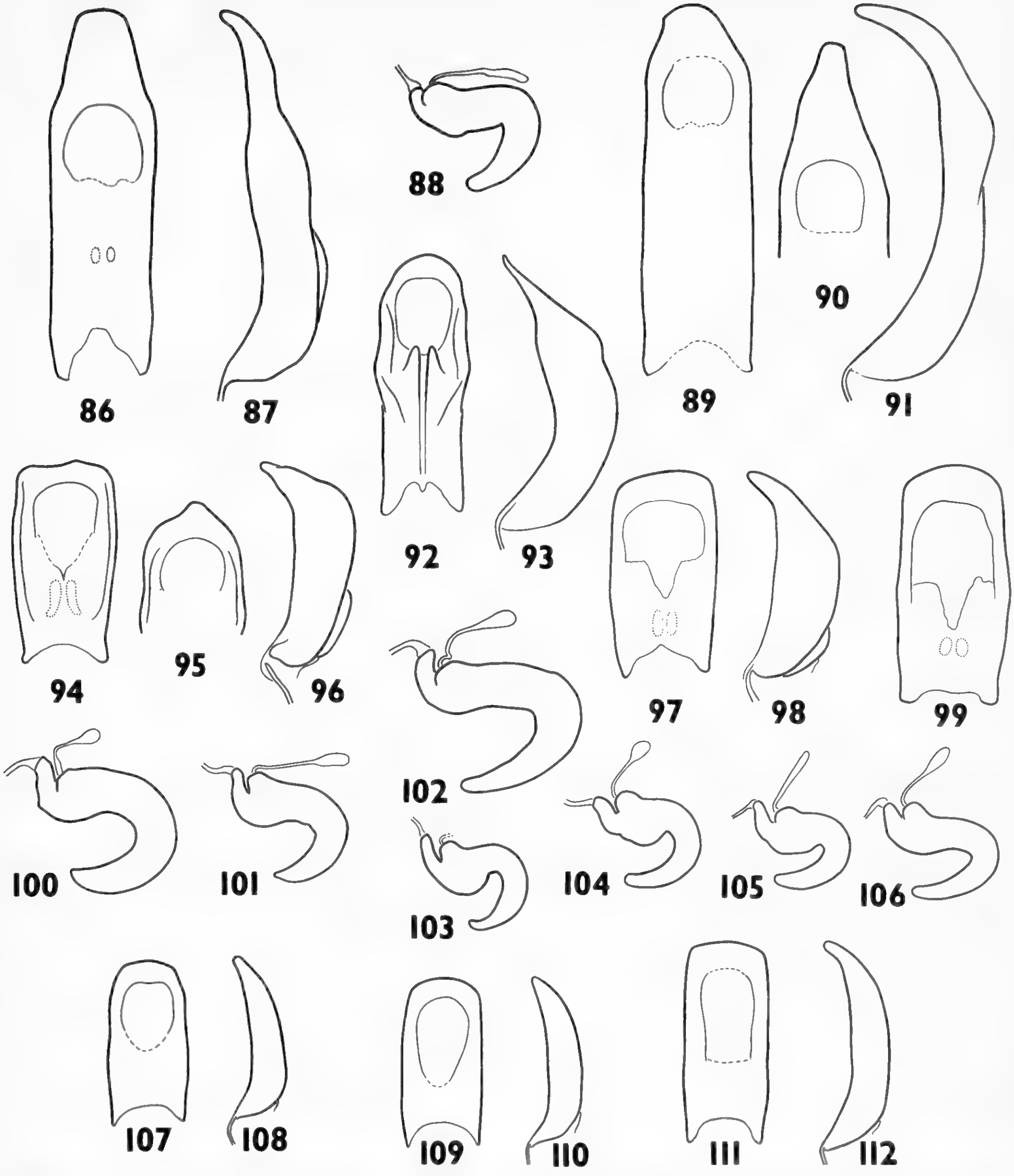

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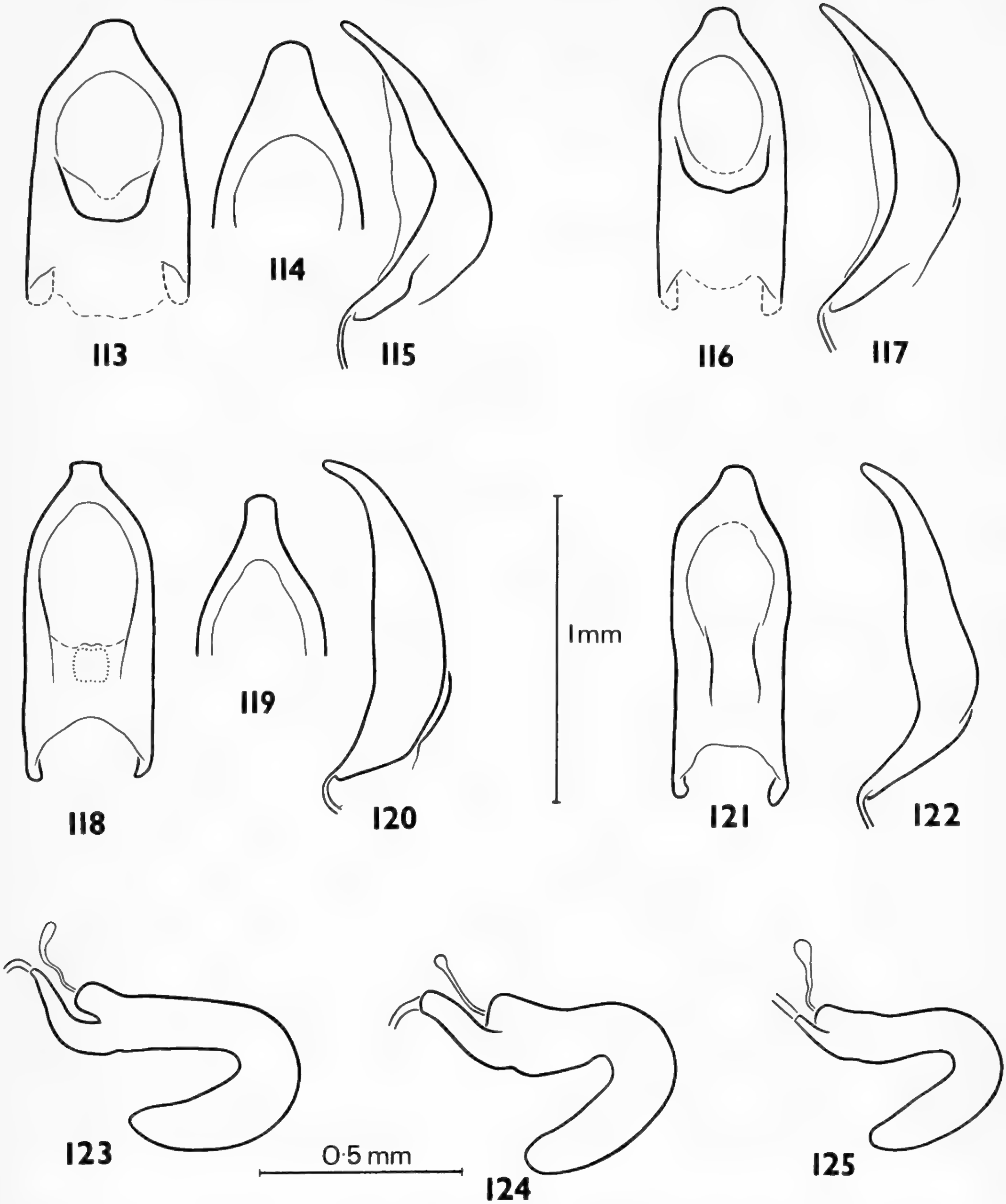

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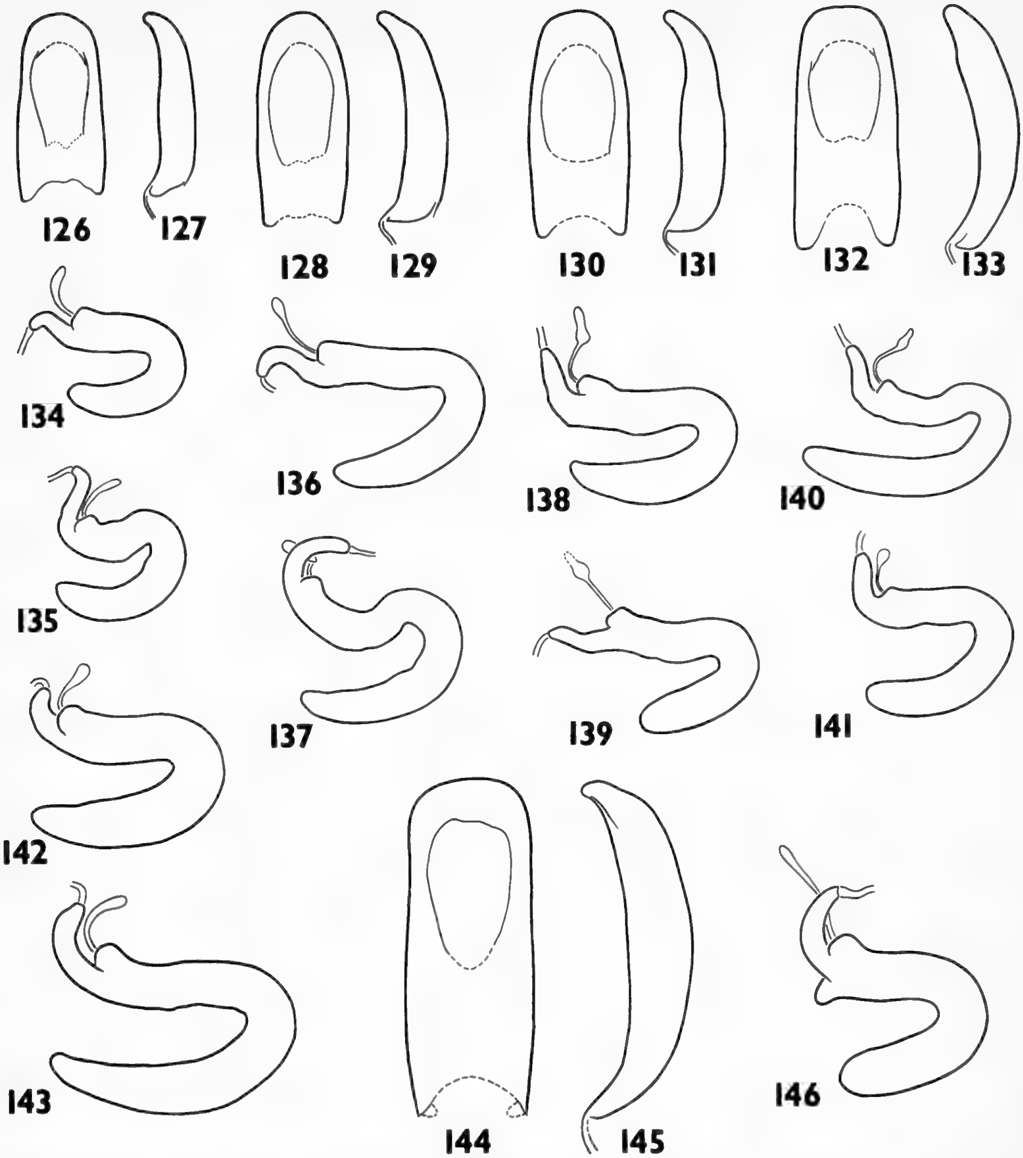

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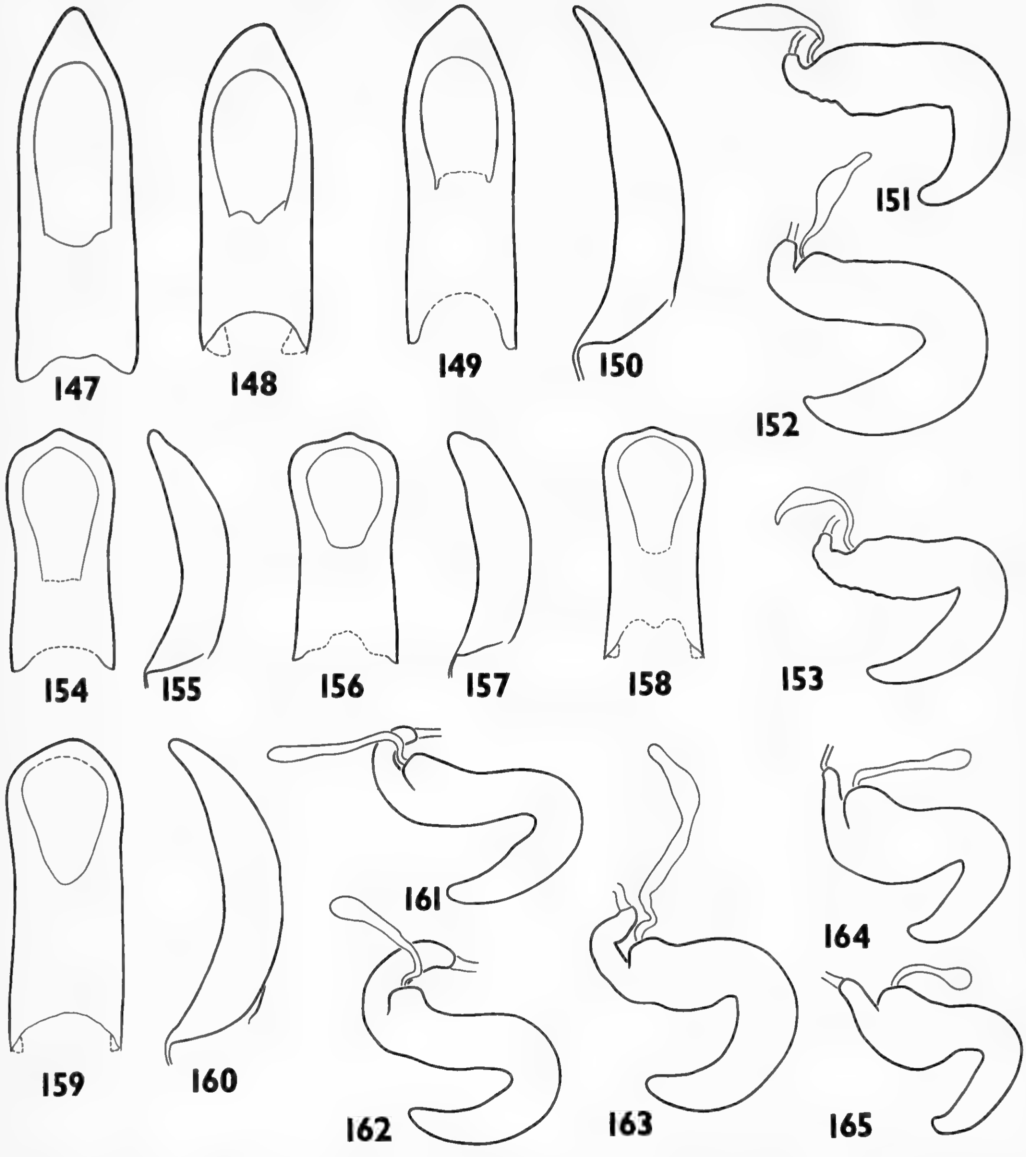

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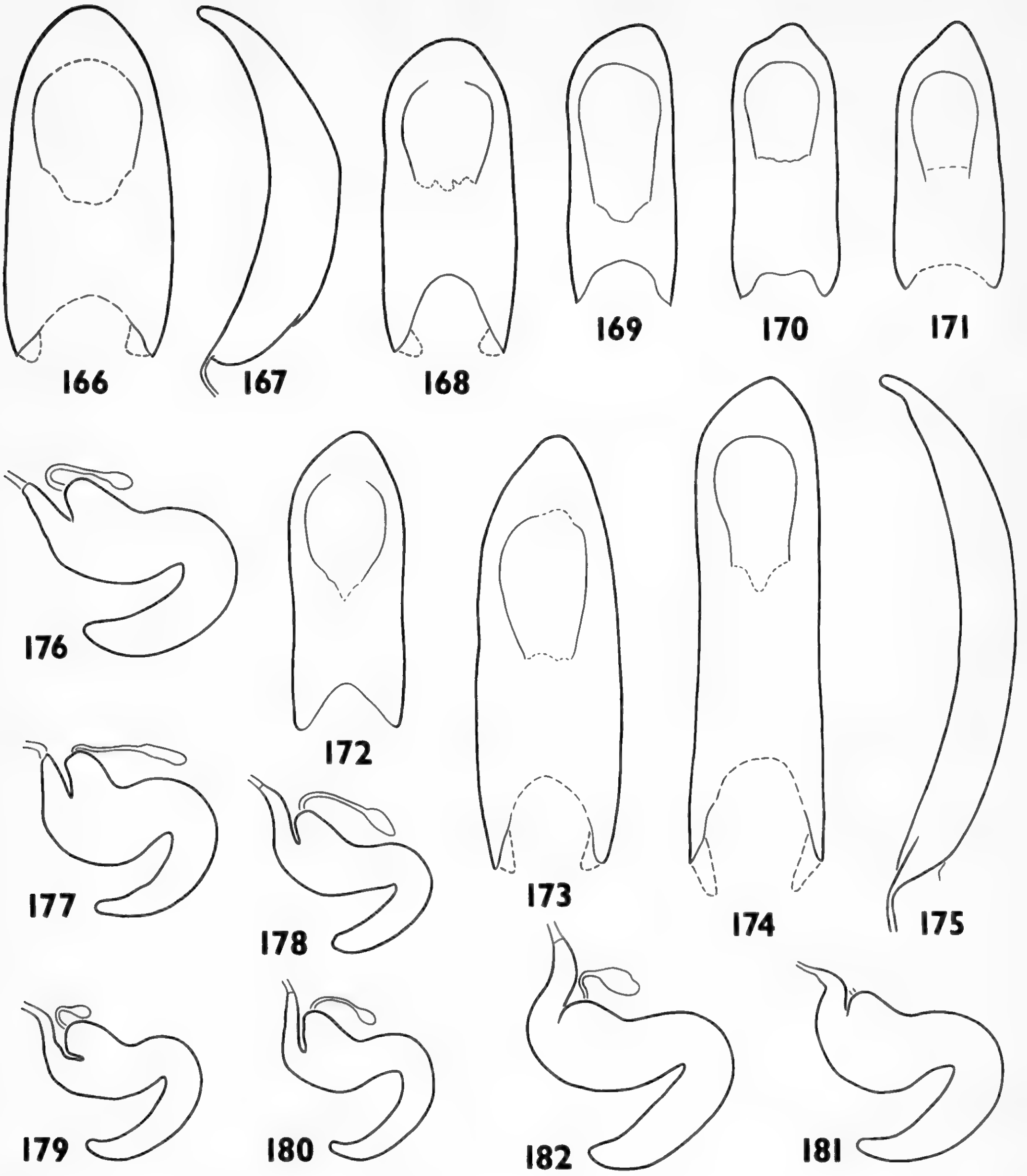

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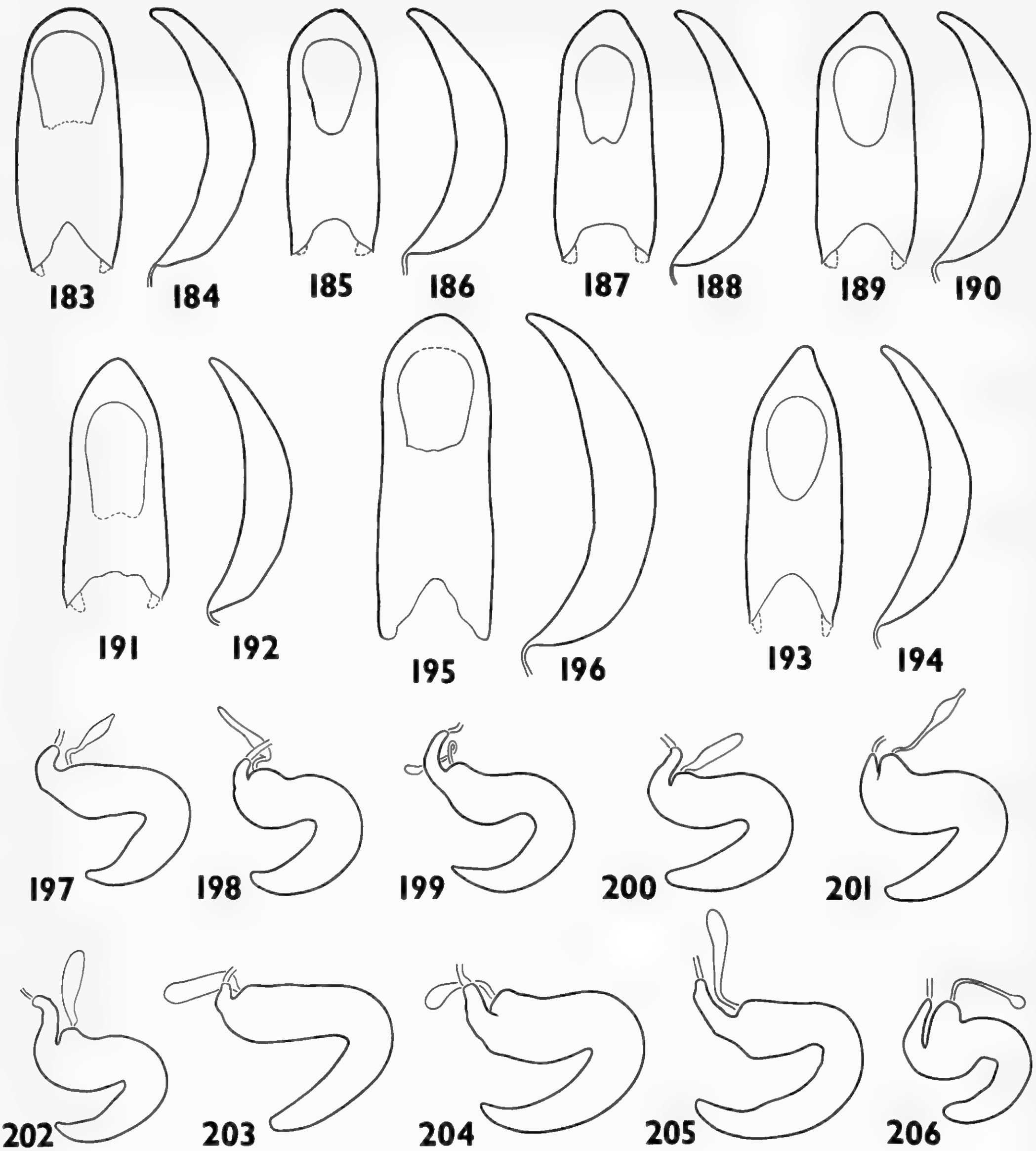

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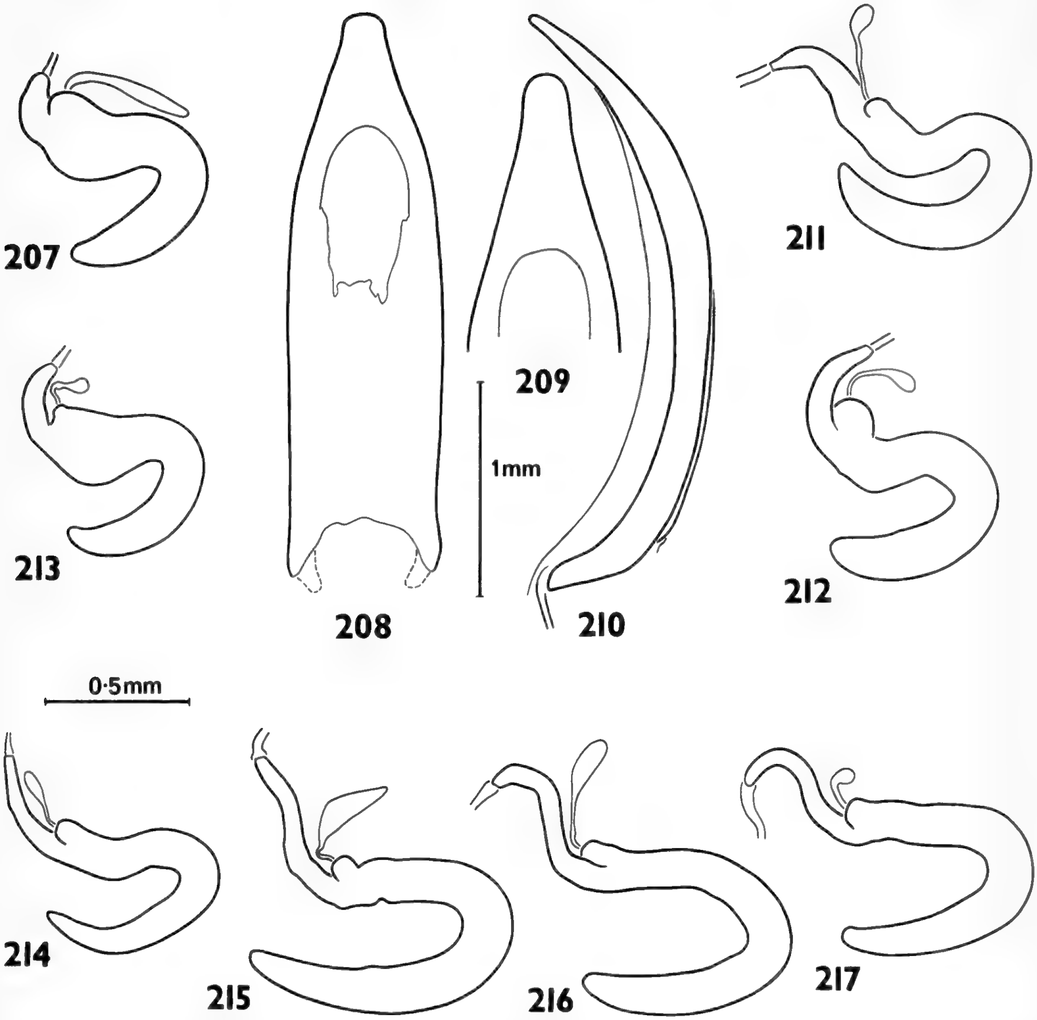

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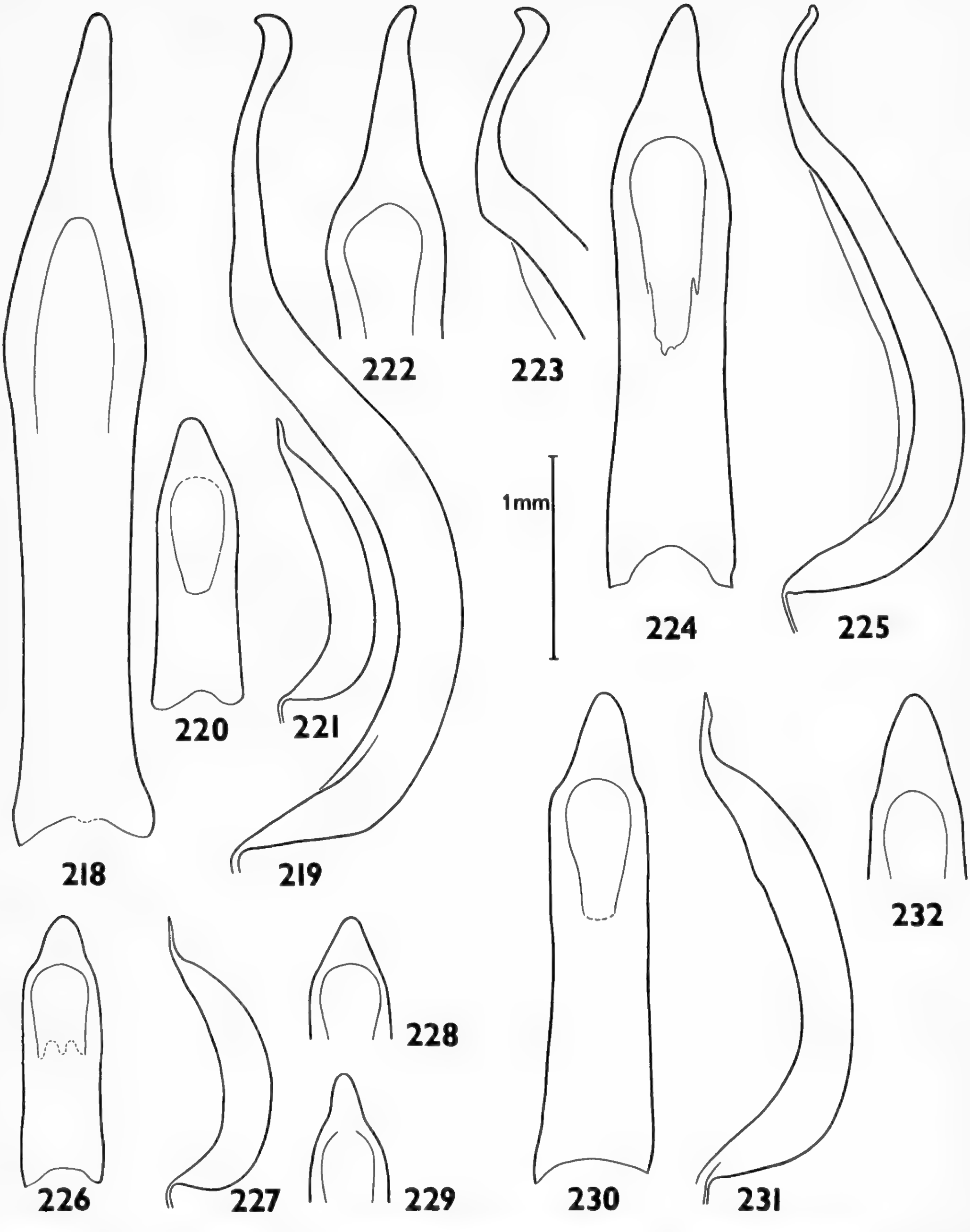

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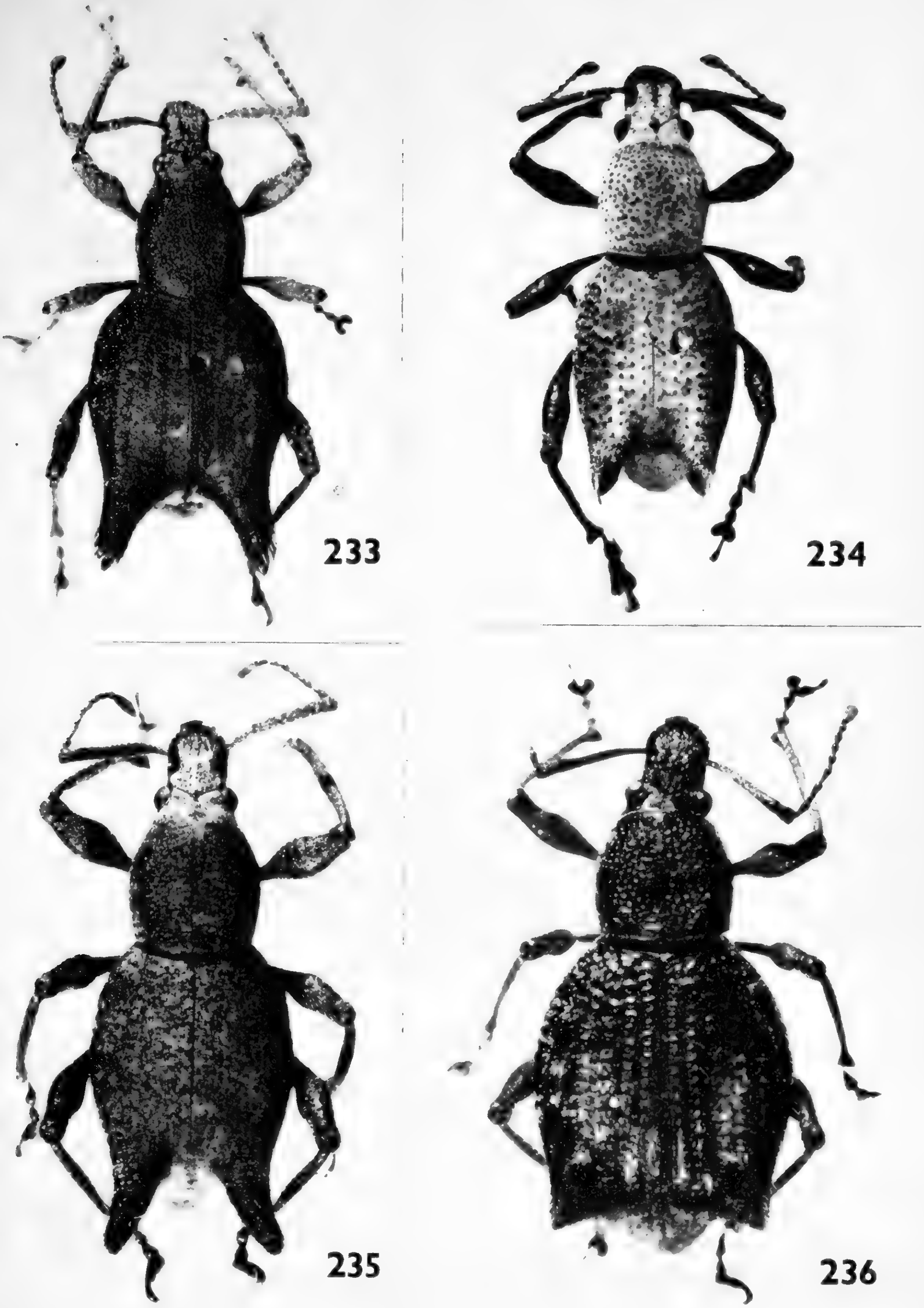

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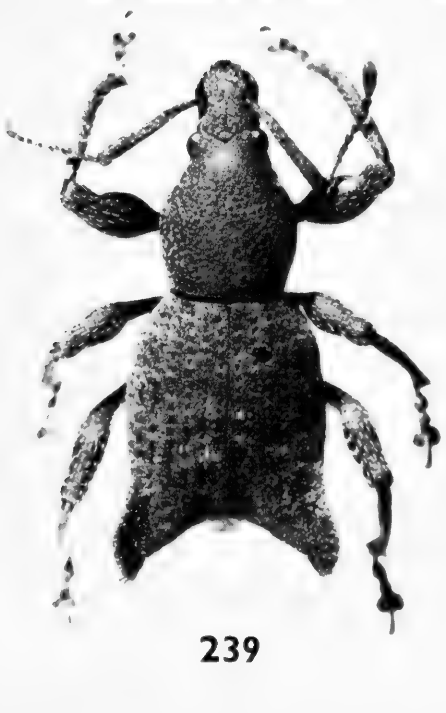

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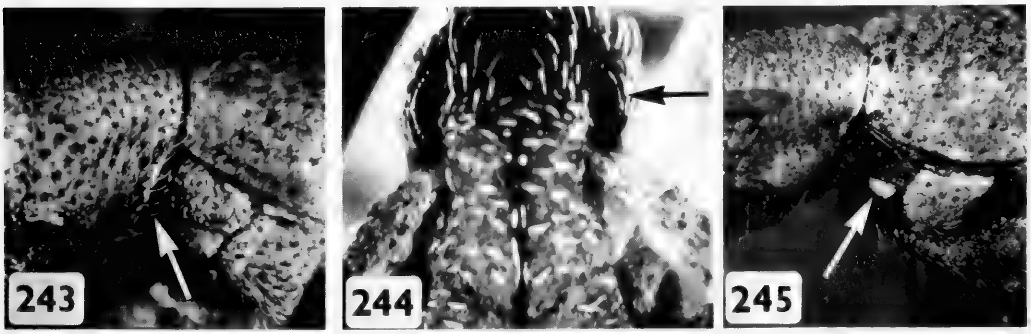
Fig. 241 *Apirocalus* (*A.*) *acutus* ♂ (holotype).

Fig. 242 *Albertisius gestroi* ♂.



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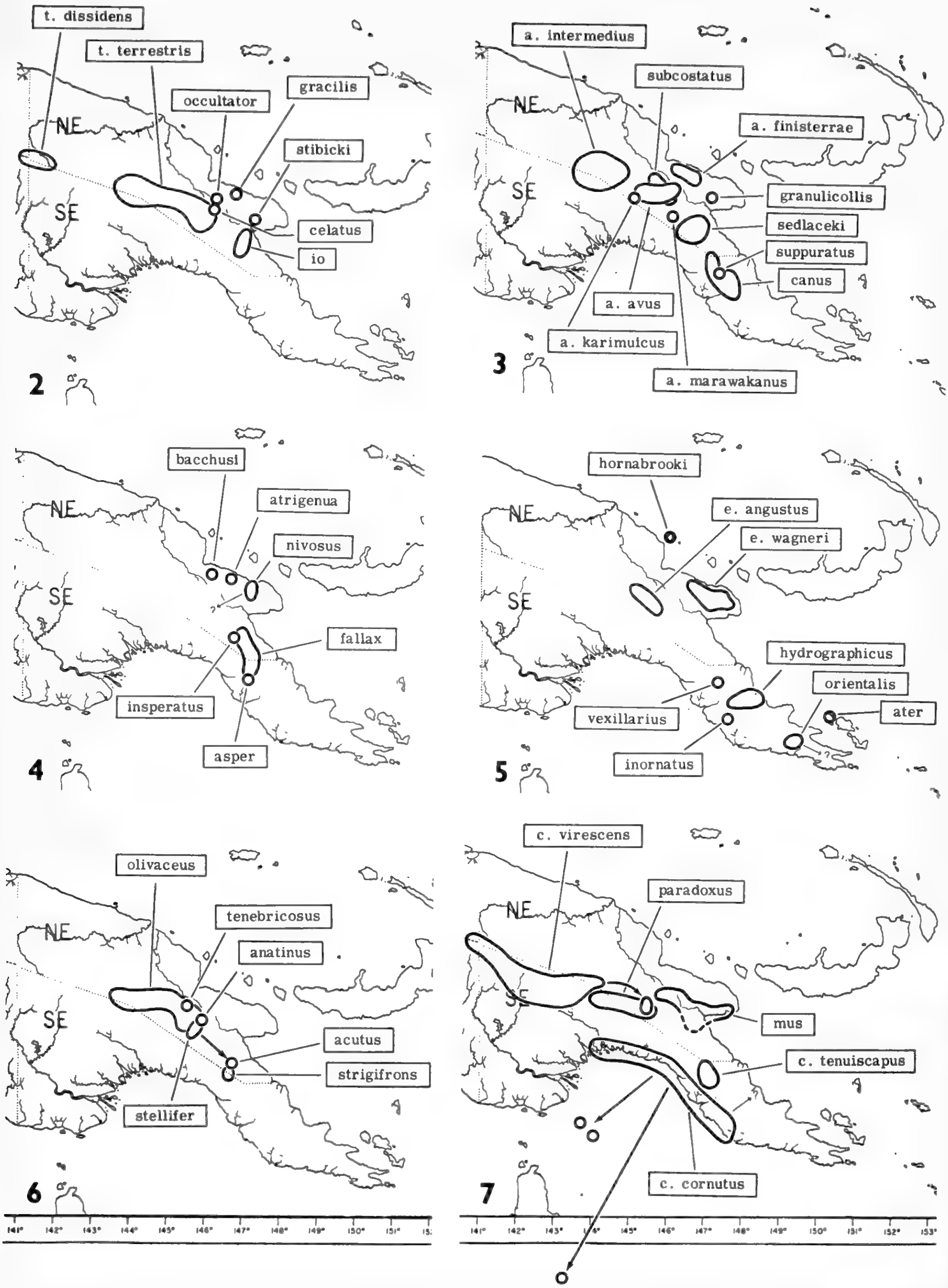

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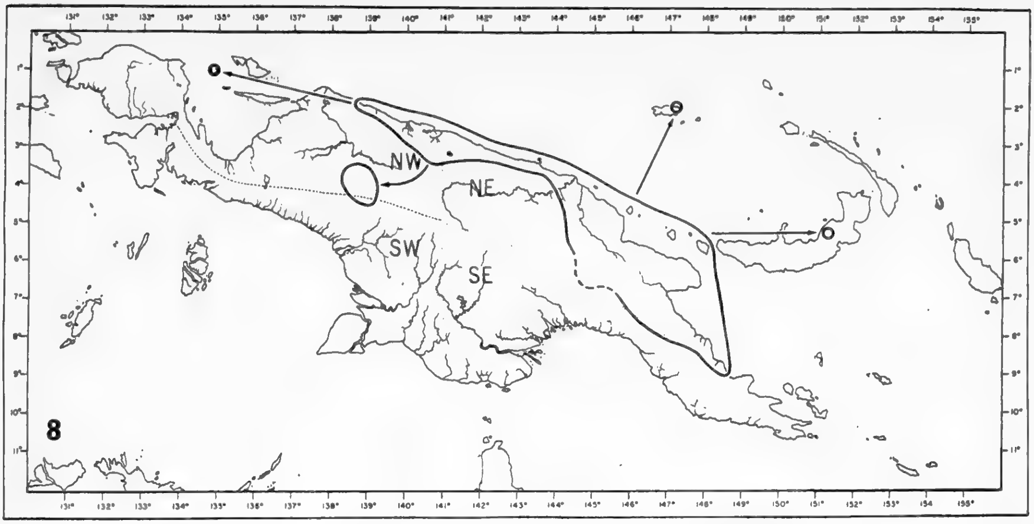

Map 8 Range of *Apirocalus e. ebrius* (*cornutus*-group).

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A revision of the Oriental pod bugs of the tribe Clavigrallini (Hemiptera: Coreidae)

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Contents

Synopsis

The morphological characteristics of the tribe Clavigrallini are outlined and its systematic position is discussed. Three genera, two of them new, are recognized in the Oriental region and are described and keyed. Nineteen species and four additional subspecies are recognized in the region and are described and keyed. Twelve of the species are new and two are revived from synonymy. All of the additional subspecies are new. Three new specific synonymies are established. Six lectotypes are designated.

Introduction

Species of the tribe Clavigrallini are found almost throughout the Ethiopian and Oriental regions where they are known to economic entomologists as pod bugs or spiny brown bugs. This account is concerned with those species of the tribe which occur east of the Arabian Gulf, including peripheral populations or species whose ranges extend into the extreme southern edge of the Palaearctic region and into northern Australia and the Pacific.

The main recorded host plants of Clavigrallini are herbaceous Leguminosae of erect or ascending habit, and some species have the status of minor pests on pulse crops. Because they frequently occur in the field together with certain Alydidae it is often difficult to assess their importance as pests. Field studies have shown that most damage is caused by adult bugs feeding on the unripe pods. Bindra (1965) demonstrated that on *Cajanus cajan* Linnaeus (red gram, pigeon pea or tur) a density of ten adults per plant of *Clavigralla gibbosa* Spinola (the tur pod bug) could cause total or almost total loss of the crop.

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Systematic position

The tribe Clavigrallini was erected by Stål (1873 : 81) as division Clavigrallaria of subfamily Pseudophloeina (now Pseudophloeinae) of the family Coreidae, a systematic position which is accepted here.

The exact relationship between the family-group taxa related to the Coreidae cannot be established without further study. Recognizably monophyletic groups in this area are Alydinae, Micrelytrinae and Leptocorisinae (often grouped together under Alydidae, which may be a paraphyletic grouping), Rhopalidae, Pseudophloeinae, Hydarinae and Coreinae (the last including family-group taxa based on *Colpura* Bergróth, *Agriopocoris* Miller and *Phyllomorpha* Laporte). Both Hydarinae and Pseudophloeinae share a number of character states with the Alydid subfamilies but these all appear to be plesiomorphies and thus without value in indicating phyletic relationship.

Pseudophloeinae may be distinguished from the other family-group taxa of Coreoidea by the following complex of characters: tibiae terete, not sulcate; metathoracic scent-gland peritreme with dorsal ridge entire or shortly bilobed, not drawn out into a Y-shaped auricle; antennae inserted at sides of head; antennifers with porrect or deflexed process at outer apical angles; rostrum at rest reaching metasternum; posterior coxae separated by about the width of a coxa or less; femora moderately to strongly clavate; posterior femora typically with two or more large subapical spines beneath on anterior side with some smaller spines, tubercles or granules between them and a terminal series of about four spines diminishing in length towards apex of femur; tibiae without apical spines; membrane of hemelytron with a compound vein near base almost parallel with apical margin of corium; posterolateral angle of sternite VII almost always and of sternites III–VI commonly produced into teeth or spines; female paratergite VIII without functional spiracle; first valvula of ovipositor without peg-like setae; spermatheca with bulb lunate and duct devoid of prominent flange; dorsal wall of gynatrium with a well-developed pair of sclerites each with a transverse, anterior arm and a longitudinal, medial arm, often with a descending, anterior arm or plate, never ring-shaped; basal apparatus of aedeagus without ventroposterior apodemes; paraphyses absent; conjunctiva and ejaculatory reservoir complex almost completely bilaterally symmetrical; vesica not protected by a helicoid sclerite ('spiral process'); egg not operculate or pseudoperculate, opening by a transverse eclosion rent.

In his original description of the tribe Clavigrallini, Stål (1873 : 81) indicated the convex scutellum, the absence of a basal tubercle from the base of the posterior femur, the posterior closure of the male genital capsule, the sinuate posterior margin of the propleuron near its posterolateral angle, the relative lengths of the antennal segments (III never longer than II) and the usually long spines at the posterolateral angles of the pronotum. Not all of these characteristics are universal in the tribe, however. All species of Clavigrallini can be distinguished from all other Pseudophloeinae on the basis of two character states: the posterior femur invariably lacks a basal tubercle and the metathoracic wing invariably has an atracheate antevannal vein. The latter condition was believed by Stål to be a subfamily character, but the antevannal is absent from three undoubted Pseudophloeine genera: *Hoplolomia* Stål, *Vilga* Stål and *Risbecocoris* Izzard. As the possession of an antevannal vein appears to be apomorphic for Pseudophloeinae as it is for Coreinae, the nominate tribe Pseudophloeini as at present constituted is presumed to be paraphyletic.

Abbreviations of depositories

The specimens studied in the course of this revision are deposited in the various institutions whose names are abbreviated in the text as follows: South Australian Museum, Adelaide, South Australia (SAM, Adelaide); University of Queensland, Brisbane, Queensland, Australia (UQ, Brisbane); Universitetets Zoologiske Museum, Copenhagen, Denmark (UZM, Copenhagen); Institut für Pflanzenschutzforschung, Eberswalde, German Democratic Republic (IP, Eberswalde); Bernice P. Bishop Museum, Honolulu, Hawaii, U.S.A. (BPBM, Honolulu); Rijksmuseum van Natuurlijke Historie, Leiden, Netherlands (RNH, Leiden); British Museum (Natural History), London, U.K. (BMNH, London); American Museum of Natural History, New York, U.S.A. (AMNH, New York); University Museum, Oxford, U.K. (UM, Oxford);

Naturhistoriska Riksmuseum, Stockholm, Sweden (NR, Stockholm); Instytut Zoologiczny, Polska Akademia Nauk, Warsaw, Poland (IZPAN, Warsaw).

Terminology and measurements

The segments of the antennae and rostrum are numbered I to IV starting with the most proximal segment. Lengths of antennal segments are measured from the nearest point to the proximal end of each segment where normal surface sculpture is evident. This eliminates variation in apparent length due to the variable degree of retraction of the bases of the segments into the preceding joints. The ring segment between segments III and IV is omitted from the measurements. The lengths of the segments of the rostrum are measured along the true dorsal surface, i.e. the surface seen when the insect is examined in ventral view with the rostrum at rest. The origin of the first segment is taken as the base of the labrum, which can be easily seen in this view, rather than the base of the first labial segment, which is usually obscured. For this reason, the segments are referred to as 'rostral' rather than 'labial' segments. In referring to the angles of the pronotum the term 'humeral angle' is avoided as it has been variously applied to the posterolateral angles, the posterolateral angles of the posterolateral lobes of the pronotum (which lie posterior to the posterolateral angles) and to the prescutellar angles. Similarly, the term 'humeral spine' is avoided.

In most cases where ranges and means of lengths or ratios of lengths are given the number of specimens measured is cited in the form '(n = x)'. Standard errors are not given because the calculations by which they are derived are based on the assumption of a normal distribution of observations about the mean, which is unlikely to occur in the case of museum material which often comprises series of varying length from several different populations.

Ratios are preferred to absolute measurements of length because by this means of presenting the data much of the variation due to overall body size is eliminated. There is no obvious indication of allometry in the material studied. In the ratios of lengths of antennal and rostral segments means only are used, as the addition of means and ranges for each segment would make the descriptions unnecessarily unwieldy. Where a particular ratio is of diagnostic importance it is treated separately, in full.

Morphology of Clavigrallini

Comparative accounts of the morphology of a variety of Coreidae, including some Pseudophloeinae but not Clavigrallini, are given by Kumar (1965) and Schaefer (1965). Cobben (1968) studied the eggs of three members of the subfamily, including one African species of Clavigrallini and Materu (1972) described and discussed the morphology of adults and immature stages of two African pest species of Clavigrallini. The present account is based chiefly upon original observations on *Clavigralla gibbosa* Spinola, with additional observations on species of other genera of the tribe.

Antennae inserted at sides of head (Fig. 1) just above an imaginary line joining centre of eye to apex of tylus (the 'supericorn' position). Antennifer exteriorly at apex bearing a process whose form is constant within species-groups or genera but varies between them. All antennal segments elongate, segment IV with area of specialized sensory setae occupying nine-tenths or more of its length. Rostrum moderately long, reaching to but not beyond metasternum when at rest, segment III always the shortest. Head short (Fig. 1) to moderately elongate (Fig. 30). Bucculae always short and usually almost semicircular, rarely angulate. Ocelli raised on prominent tubercles and approximately equidistant from eyes and from one another. Preocellar pits usually small and indistinct, midline of frons with a pair of deep, narrow, parallel, longitudinal pits.

Pronotum in dorsal view roughly hexagonal, width of anterior margin approximately half width of posterior margin, greatest width across the slightly to strongly prominent posterolateral angles, each of which bears a slender spine. Posterior margin almost straight or slightly concave in front of scutellum, with a pair of prescutellar spines in front of anterior angles of scutellum. Scutellum with disc convex, often strongly so, with midline depressed and flanked by a row of granules (rarely spines in African species). Scutellum at base (see Fig. 71) with a pair of small knobs which appear to prevent posterior

margin of pronotum overriding scutellum (these knobs are invariably present and are unique to the tribe). Metapleural scent-gland opening (Figs 7, 37, 38) situated laterally and surrounded by a small evaporative area, dorsal ridge of auricle not drawn out into narrow arms but sometimes shortly bilobed (Fig. 37). Mesosternum and metasternum shallowly longitudinally sulcate throughout. All femora clavate, especially the posterior pair, which lack a basal tubercle. Anterior and intermediate femora with one or more small spines on ventral surface near apex anterior to midline, so positioned that tibia, when flexed against femur, lies just posterior to them. Posterior femur (Fig. 6) with a row of spines in this position, typically with two major spines with some smaller spines, tubercles or granules between them and a terminal series of four spines or tubercles diminishing in length towards apex of femur. Occasionally posterior femur with additional major spines, evenly spaced, with granules or tubercles between them, and a few small spines or tubercles posterior to midline so that flexed tibia lies between the two rows. Hemelytron (Fig. 8) narrow, apex of corium distinctly produced along costal margin. Membrane with about ten longitudinal veins distinguishable and with three basal cells delineated by tracheate longitudinal veins and compound transverse vein. Wing (Fig. 9) with typical Coreoid venation and additionally invariably with an atracheate antevannal vein parallel with and just anterior to first vannal fold, merging apically with *CuA*.

Abdominal terga I and II strongly sclerotized, demarcated from each other by a deep furrow marked internally by a fold but showing no flexibility at this suture; terga III–VI immovably fused together, but sutures not completely obliterated (Fig. 13); suture between terga II and III marked by a fold internally and showing some flexibility, that between VI and VII free at sides but fused in middle. Segments II–VI with outer laterotergites, III–VI also with inner laterotergites, longitudinal sutures between laterotergites and their neighbouring sclerites allowing free mobility, transverse sutures between laterotergites allowing less mobility. Tergum VII with imperfectly separated outer laterotergites but no inner laterotergites. Sternum I absent, II–V in male (Fig. 12) or II–IV in female fused immovably but with sutures visible, sutures between IV and V in male and between V and VI in both sexes allowing free mobility so that the sternite posterior to each suture can be partially retracted into the one anterior to it (Fig. 12). Sterna III–VII with posterolateral angles slightly (Fig. 11) to strongly and spinously (Fig. 40) produced. Sternum VII in female usually apically cleft in midline, cleft sometimes secondarily obliterated. Sterna II–VII with functional spiracles, III–VII with short trichobothria distributed in the usual Coreid pattern.

Male abdominal segment VIII comprising a single sclerotized ring (Figs 12, 13) with or without a pair of scars marking position of rudimentary, non-functional spiracles. Genital capsule (segment IX) (Figs 12, 13, 22) usually with a broad, posterior lip completely filling posterior emargination and with a triangular (Fig. 68), truncate (Figs 69, 70) or trifid (Fig. 22) tongue. Parameres with narrow shaft and broader blade, never club-shaped, blade often flattened. Parandria or paraphyses absent. Basal plate and associated structures (Fig. 19) of usual form but lacking ventroposterior apodemes. Internal ligaments of aedeagus ('hyaline band') complex. Phallotheca (Figs 19–21) with two narrow, parallel, longitudinal dorsal sclerites and a broad, ventral sclerite. Conjunctiva (Figs 19–21, 53, 54, 82–84) with various lobes which may be all membranous or wholly or partly sclerotized. Ejaculatory reservoir (Fig. 20) symmetrical, bearing a symmetrical pair of long, spreading wings to which are articulated near the base two long, symmetrical, descending straps. Vesica rather stout, internally sclerotized, with two fairly tight, helicoid turns at base, otherwise not coiled, flanked at base by a pair of roughly equal sized and more or less symmetrical sclerites arising from posterior wall of conjunctiva. These sclerites, which may be fused together, are homologous with the 'spiral (or helicoid) process of the vesica' in higher Coreidae. Immediately below these sclerites arise the contiguous, paired, roughly globular apical ventral lobes. Lateral to the apical ventral lobes arise the distal ventrolateral lobes, which are usually the largest lobes of the conjunctiva and are frequently subdivided. Sometimes their posterior faces are sclerotized to a greater or lesser degree. Directly above the distal ventrolateral lobes arise the distal dorsolateral lobes which may be rudimentary (Figs 19, 20) or well developed in which case they may be entirely membranous (Figs 53, 54) or the apices of the wings of the ejaculatory reservoir complex may be produced along their ventroposterior surfaces as a sclerotized strip (Figs 82–83). In those cases where the wings are not so produced they terminate in the conjunctival wall just below the origin of the distal dorsolateral lobes (Fig. 20). Dorsally between the distal dorsolateral lobes arises the distal dorsomedian lobe from the anterior side of which, near the base, may arise the intermediate dorsal lobe. Anterior to the distal dorsomedian and intermediate dorsal lobes lies the dorsomedian lobe, a transverse ridge whose dorsolateral angles are frequently produced (Fig. 18) and sometimes sclerotized (Figs 19, 20). Ventrally, close to the point where the straps of the ejaculatory reservoir complex terminate just within the conjunctival wall, may arise a pair of small, membranous or sclerotized, ventral lobes (Figs 18, 20, 21). Other lobes may be present, for example the paired, T-shaped lobes arising from the posterior face of the conjunctiva in *Clavigralla scutellaris* (Westwood) or the lateral protuberances associated with the dorsomedian lobe in *Gralliclava* species (Fig. 83).

In the female, suture between terga VII and VIII allows some flexibility, especially at sides; tergum IX hinging freely on VIII. Segments X and XI modified into a retractile anal tube which may be protracted posteriorly where tergum IX is horizontal (Figs 23, 27) or ventrally where tergum IX is deflexed (Figs 87, 88). Sternum VIII represented by a pair of triangular or quadrate paratergites fused dorsally with tergum VIII and bearing rudiments of the non-functional spiracles. First valvifer (gonocoxa VIII) broad, roughly quadrate, first valvula (gonostylus VIII) triangular, without peg-like setae, with a broad, membranous articulation to valvifer, its ramus fused apically to gonangulum (Figs 26, 89). Sternum IX represented by a pair of paratergites without spiracles, fused dorsally with tergum IX and prolonged anteriorly as gonangulum of each side. Second valvifer (gonocoxa IX) long, second valvula (gonostylus IX) oblong, shape often diagnostic at species level (Figs 55–57, 90–102). Spermatheca usually with bulb narrowly lunate and duct short, not convoluted, communicating with gynatrial sac (Figs 27, 86). Gynatrial sac supported by posteriorly projecting inner arms of sclerites of anterior wall of gynatrium. Anterior, laterally spreading arms of sclerites of gynatrial wall terminating at junction of second valvulae and rami (Figs 27, 88).

Sculpture of integument consisting usually of round punctures and granules or tubercles. Granules and tubercles each bearing, apically or subapically, a single hair. Posterior part of pronotum and thoracic pleura often with granulate-punctate sculpture in which a puncture lies immediately posteriad of each granule.

Pubescence of three types: (1) erect, suberect or semidecumbent, usually colourless or pale brown or amber, simple hairs; (2) semidecumbent or decumbent, flattened, silvery or golden hairs which, if long, are usually tomentose; (3) densely felted, white hairs in lines or patches, found only in *Gralliclava*.

Egg with fewer than ten, usually six or seven aeromicropyles, oblong-ovate, slightly flattened on dorsal surface.

Systematic section

Key to Oriental genera of Clavigrallini

1 Pronotum (Figs 67, 71) without large tubercles on disc or at sides; female abdomen with apex (Figs 85–88) deflexed . . . . ***GRALLICLAVA*** gen. n. (p. 304)

– Pronotum (Figs 2–5, 31–36) with large tubercles on disc or at sides; female abdomen with apex (Figs 23, 27) not deflexed 2

2 Pronotum (Figs 31–36) with a group of four large tubercles on disc ***CLAVIGRALLOIDES*** gen. n. (p. 293)

– Pronotum (Figs 2–5) with a pair of large tubercles near lateral margins behind level of calli ***CLAVIGRALLA*** Spinola (p. 285)

CLAVIGRALLA Spinola

Clavigralla Spinola, 1837 : 200. Type-species: *Clavigralla gibbosa* Spinola, 1837, by monotypy.

Note. Character states given in parentheses below are restricted to non-Oriental species.

Form oblong, robust (rarely somewhat depressed), connexivum broadest in middle; aspect slightly (to strongly) spinose.

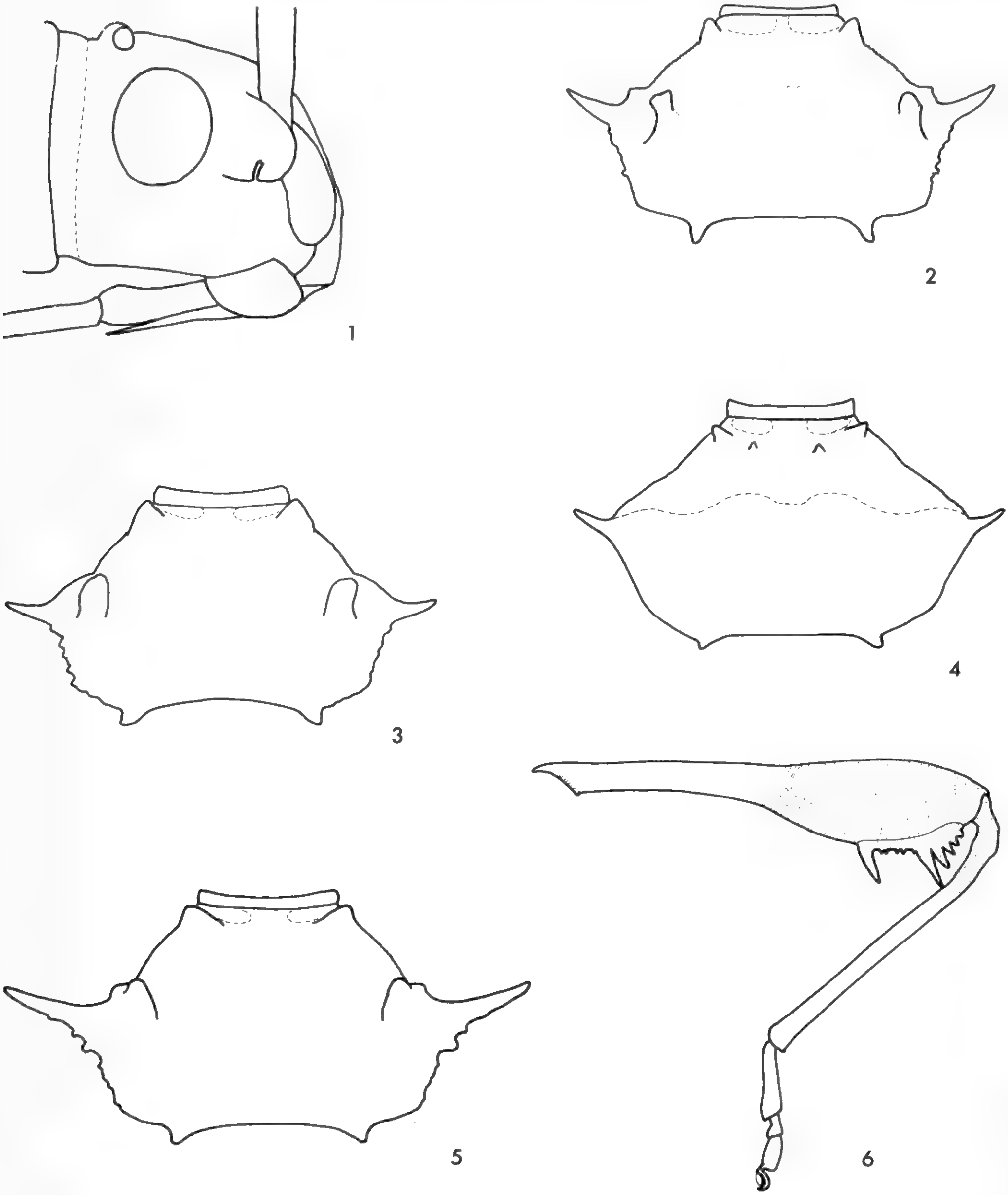
Head between one-half and three-quarters as long as pronotum. Antennifers very slightly (to strongly) divergent, process at outer apical angle broad and strongly deflexed, its apex touching maxillary plate (or short, triangular and porrect). Antennae with segment I or IV longest, II or III shortest, IV elongate fusiform, area of specialized sensory setae occupying about 95 per cent of its length, II and III more slender than I or IV. Rostrum with segment III always the shortest, its apex when at rest reaching disc of metasternum. Bucculae occupying about one-quarter of length of ventral midline of head.

Pronotum strongly (or rather strongly) declivent anteriorly, posterolateral angles weakly (to very strongly) produced, each bearing a slender spine; posterior margin in front of scutellum straight, prescutellar angles each marked by a short spine; disc with or without small spines, never with a group of four short, stout tubercles, with a pair of short, stout tubercles close to lateral margins about halfway between collar and posterolateral angle (these tubercles rarely absent). Scutellum equilateral or slightly longer than its basal width, apex slightly produced, disc (weakly to) strongly convex, midline impressed. Mesosternum and metasternum broadly sulcate in midline. Metapleural scent-gland orifice with dorsal ridge of peritreme entire, shortly reniform (or bilobed). Corium with apex somewhat produced, reaching posteriorly to laterotergite V or VI at rest. Wings with antevannal vein well developed. Anterior and

intermediate femora with 0–1 (–2) small subapical spines beneath, posterior femur with 2 (–3) major subapical spines beneath, some small spines, tubercles or granules between them and a terminal series of four spines.

Abdominal sterna III–VII weakly (to very strongly and spinously) prominent.

Male genital capsule with lip (narrow or) broad, filling (or not filling) posterior emargination, tongue apically trifid (or entire, acute). Phallotheca with a large, ventral sclerite and two narrow, parallel, dorsal sclerites. Lobes of conjunctiva variously developed, with some lobes or processes sometimes weakly or



Figs 1–6 *Clavigralla* species. (1) *gibbosa*, right lateral view of head; (2) *gibbosa*, dorsal view of pronotum; (3) *orientalis orientalis*, same; (4) *scutellaris*, same; (5) *orientalis serica*, same; (6) *gibbosa*, posterior view of posterior femur, tibia and tarsus. Dotted or dashed line in Figs 2–5 indicates boundary between anterior area of pale coloured pubescence and posterior area of dark coloured pubescence.

strongly sclerotized. Ejaculatory reservoir complex symmetrical, with wings and straps well developed, sclerites protecting base of vesica paired, slightly asymmetrical but of comparable size.

Spermatheca with bulb narrowly lunate, duct simply looped or slightly (to considerably) convoluted. Second valvulae and sclerites of gynatrial wall variable in form. Tergum IX of female in same plane as rest of abdominal tergites, anus directed posteriad.

REMARKS. Oriental species differ from those of the other two Oriental genera in the presence of a pair of short, stout tubercles close to the lateral margins of the disc of the pronotum, and the absence of any other similar tubercles on the disc. All Oriental (and many Ethiopian) species have a well-marked division of the pubescence of the pronotum into a white or yellowish white anterior area and a brown posterior area.

DISTRIBUTION. The majority of the species are restricted to the Ethiopian region and adjacent islands, but a few are present in the Oriental region from Pakistan and Ceylon to China and Java.

Key to Oriental species

1 Junction between anterior area of pale pubescence and posterior area of dark pubescence on pronotum following a gently undulating line (Fig. 4). (India except the north-eastern part, Pakistan; also in southern Arabia and north-eastern Ethiopian region) **C. scutellaris** (Westwood) (p. 291)
– Junction between areas of pale and dark coloured pubescence on pronotum following a strongly undulating line (Figs 2, 3, 5) 2
2 Male paramere (Fig. 14) with blade large. (Ceylon and peninsular India except the north-eastern part) . . . . **C. gibbosa** (Spinola) (p. 287)
– Male paramere (Figs 15, 16) with blade small. (North-eastern India, S. China and south-eastern Asia) (**C. orientalis** sp. n.) 3
3 Antenna with segment IV distinctly shorter than segment I; width of pronotum across tips of posterolateral spines divided by width of head including eyes in male less than 3·0, in female less than 3·2. (Northern India and Burma south-eastwards to Java) **C. orientalis orientalis** subsp. n. (p. 290)
– Antenna with segments I and IV subequal in length; width of pronotum across tips of posterolateral spines divided by width of head including eyes in male greater than 3·0, in female greater than 3·1 (S. China) . . . . **C. orientalis serica** subsp. n. (p. 291)

Descriptions of Oriental species

Clavigralla gibbosa Spinola
(Figs 1, 2, 6–10, 12–14, 19–24, 26, 27)

Clavigralla gibbosa Spinola, 1837 : 202. LECTOTYPE ♀, INDIA: Bombay (Castella di Tassarolo, Novi Ligure, Genoa), here designated [photographs examined].

Length: ♂, 8·1–8·9 mm, mean 8·6 mm (n = 5); ♀, 9·2–10·8 mm, mean 9·9 mm (n = 10).

Antennifers very slightly divergent, almost parallel, outer apical angles each with a broad, deflexed process (Fig. 1). Ratio of lengths of antennal segments I : II : III : IV about 1·00 : 0·75 : 0·68 : 1·04 in male, in female about 1·00 : 0·77 : 0·69 : 0·99; length of segment I divided by width of head including eyes in male 1·26–1·34, mean 1·30 (n = 7), in female 1·18–1·36, mean 1·27 (n = 10). Ratio of lengths of rostral segments I : II : III : IV in both sexes about 1·00 : 0·95 : 0·74 : 1·14.

Pronotum (Fig. 2) strongly declivent anteriorly, posterolateral angles each with a slender, anterolaterally curved spine. Width across tips of spines divided by width of head including eyes in male 2·65–2·80, mean 2·75 (n = 6), in female 2·63–3·02, mean 2·89 (n = 10). Scutellum equilateral, strongly convex, granulate, with midline impressed. Metathoracic peritreme (Fig. 7) with dorsal ridge about as high as wide, entire. Corium with apex slightly produced, reaching apex of laterotergite V at rest. Anterior and intermediate femora without subapical spines beneath, posterior femur (Fig. 6) with two major spines, about five very small spines or granules between them and an apical series of four spines. Posterior tibia (Fig. 6) slightly curved at base, about three-quarters as long as posterior femur.

Abdominal sterna III–VII with posterolateral angles prominent as short, triangular teeth (Fig. 10). Male genital capsule (Figs 12, 13, 22) with lip high, broad, filling posterior emargination, tongue trifid at apex. Paramere (Fig. 14) with blade very broad. Phallotheca (Figs 19, 20, 21) comprising a broad sclerite ventrally and laterally and two slender, parallel, longitudinal sclerites dorsally. Conjunctiva

(Figs 19, 20, 21) with dorsomedian lobe low, flat-topped, bearing a pair of large, sclerotized appendages at its dorsolateral angles; intermediate dorsal lobe small, membranous, conical; distal dorsomedian lobe large, membranous, with a posteriorly directed, membranous, finger-like appendage; distal dorsolateral lobes obsolete; apical ventral lobes rounded, membranous; distal ventrolateral lobes well developed, membranous; ventral lobes well developed, sclerotized throughout. Sclerites protecting base of vesica paired, separate, the right one very small. Ejaculatory reservoir complex symmetrical, wings and straps both long. Female abdominal sternite VII divided for rather more than apical one-third of its length. First valvulae pointed; second valvulae narrow, apically rounded; sclerites of gynatrial wall V-shaped with median arms lanceolately broadened for apical three-quarters of their length (Figs 23, 26, 27). Spermatheca (Fig. 24) with bulb about three-quarters as long as the apically attached duct; broad, thin-walled portion of duct about one-quarter as long as narrow, thicker walled part.

Head and antennae very weakly granulate. Pronotum with disc punctate, margins near posterolateral angles strongly granulate to tuberculate; scutellum granulate; thoracic pleura weakly granulate-punctate, sterna minutely roughened; legs very weakly granulate; clavus strongly seriately punctate, corium weakly and sparingly punctate, veins granulate proximally. Abdominal pleura and abdominal laterotergites minutely roughened, terga I and II transversely rastrate, III–VII punctate, the punctures largest on disc of III, becoming smaller towards lateral margins and towards apex of abdomen, very small on tergite VII.

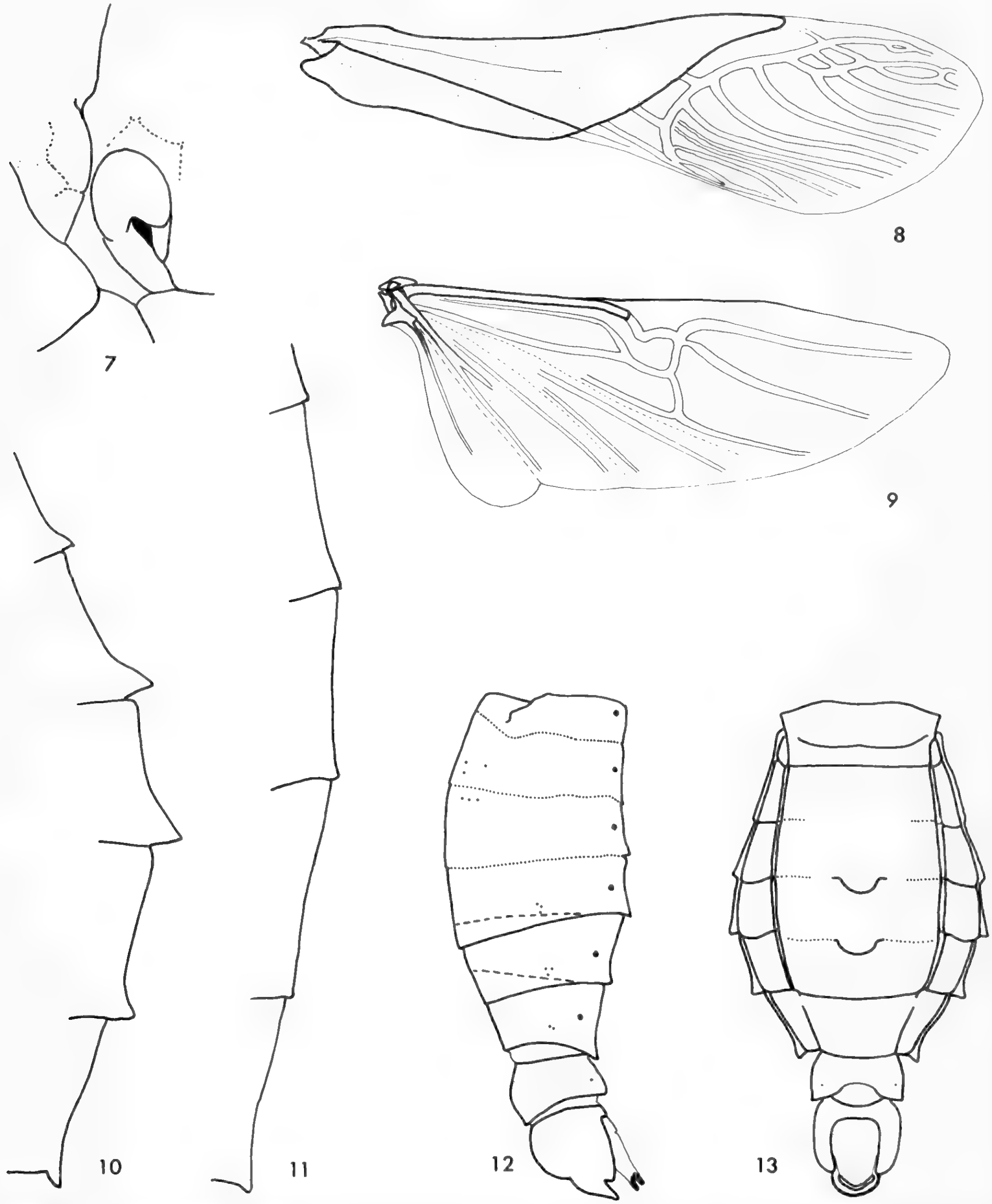
Head with short to long, pale amber to colourless, erect hairs and dense, short, silvery, decumbent pubescence. Antennal segment I with moderately long to long, suberect, pale amber hairs and sparse, short, decumbent, silvery pubescence; segments II and III with short, semidecumbent pale amber hairs. Declivent part of pronotum with long, erect, pale amber hairs and dense, long, tomentose, yellowish white pubescence, posterior level area of pronotum with dense, decumbent, golden brown pubescence with some longer, erect, pale amber hairs interspersed with it, especially on and near margins, junction of declivent and level areas of pronotum with three tufts of dense, rather short, erect, brown pubescence with the paler tomentose pubescence typical of the declivent area extending between the tufts; general effect of this distribution of types and colours of pubescence is of a pale, anterior, declivent area and a dark, posterior, level area, the junction between the two areas of colour being sharply demarcated by a strongly undulating line (dotted line on Fig. 2). Scutellum with long, erect, slightly crisped and flattened pubescence, silvery posteriorly grading to brown anteriorly. Thoracic pleura with long, erect, colourless hairs and dense, decumbent, silvery pubescence, sterna with short, sparse, decumbent, silvery hairs only. Clavus and corium with short, slightly crisped, semidecumbent silvery hairs intermingled with short, suberect, brown hairs. Legs with moderately long, suberect to erect, pale amber or colourless hairs, femora also with short, decumbent, silvery pubescence. Abdominal sterna with short, decumbent, slightly tomentose, silvery pubescence and moderately long to long, pale amber or colourless pubescence. Outer laterotergites with short, semidecumbent, silvery to golden-brown pubescence.

Head, thorax and abdomen reddish brown. Antennae stramineous, segments I and IV suffused with reddish brown. Spines of pronotum, disc of scutellum, projecting angles of abdominal sterna, anterior midline of pronotum, thoracic sterna, parts of pleura and often some large patches at sides and midline of abdominal sterna brown to piceous. Femora with basal half stramineous, often with a row of piceous spots ventrally, apical half reddish brown faintly variegated with stramineous; tibiae stramineous, suffused with pale reddish brown at base and apex, broad, basal annuli of posterior tibiae darker reddish brown; tarsi stramineous. Clavus stramineous; corium in basal half stramineous with a few small, brown or piceous spots, in apical half piceous or brown variegated with paler, reddish brown spots, produced apex of corium reddish brown without paler markings; membrane faintly and irregularly suffused with brown in basal half, extreme bases of two of its longitudinal veins and a few discrete spots between veins brown to piceous. Abdominal laterotergites III–V anteriorly with a very narrow stramineous transverse band, VI and VII very broadly stramineous anteriorly, otherwise reddish brown like the rest of the body. Tergites I–V reddish brown to piceous, VI and VII stramineous with red-brown or piceous markings.

Ovarian egg oblong-oval with one to two aeromicropyles above and four to five below eclosion slit.

Remarks. This is the 'Tur Pod Bug' of Indian entomologists. For accounts of the biology and bionomics of this species see Choudhary (1969) and especially Bindra (1965). The insect is a minor pest of various leguminous crops, feeding on the unripe pods. The most frequently recorded hosts are *Cajanus cajan* (L.), *Dolichos lablab* L. and *Vigna sinensis* (L.) (pigeon-pea, lablab and cowpea). Two species of *Hadronotus* (Hymenoptera, Scelionidae) have been recorded as parasites of the eggs. Rawat et al. (1969) record nymphs and adults of a predatory mite, *Bochartia* sp., attached to the bodies of nymphs and adults of *C. gibbosa*. Mathur & Thakar

(1969) investigated the digestive enzymes of this bug. Kurup (1964) gives an account of the structure and histology of the gut. There has been some confusion over the name of this bug, arising from the error of Fletcher (1914) whose text-fig. 361 bears the name '*Clavigralla gibbosa*' but in fact depicts *C. scutellaris* (Westwood) while the true *gibbosa* appears in his text-fig. 362 as '*Clavigralla horrens*'. Among Oriental species of the genus, *C. gibbosa* may be distinguished from *C. scutellaris* by the strongly undulating line along which the anterior pale area of pronotal



Figs 7–13 *Clavigralla* species. (7) *gibbosa*, lateral view of left metathoracic peritreme; (8 & 9) *gibbosa*, hemelytron and wing; (10) *gibbosa*, ventral view of left abdominal margin; (11) *scutellaris*, same; (12 & 13) *gibbosa*, lateral and dorsal views of male abdomen.

pubescence meets the posterior dark area. This junction follows a weakly undulating line in *scutellaris*. From *C. orientalis* sp. n. it is distinguished by the relatively longer segment III of the rostrum and the characteristic shape of the male paramere.

DISTRIBUTION. Ceylon and peninsular India except for the north-eastern part.

MATERIAL EXAMINED. *Clavigralla gibbosa* Spinola, lectotype ♀, INDIA: Bombay (*D. Dupont*) (photographs of specimen in Spinola collection, Castella de Tassarolo, Novi Ligure, Genoa, examined).

SRI LANKA: 1 ♀, Maha Illuppallama, Dry Zone Research Station, 3.ii.1959, on *Cajanus cajan* (BMNH, London). INDIA: 2 ♂, 7 ♀, Mysore, Chikballapur (*T. V. Campbell*) (BMNH, London and RNH, Leiden); 1 ♂, 4 ♀, Mysore, Bangalore (*Cameron*) (BMNH, London); 2 ♂, 4 ♀, Mysore, Bangalore (*Atkinson*) (UM, Oxford); 1 ♂, Madras, Utakamand (*Atkinson*) (UM, Oxford); 2 ♀, Madras, Kodaikanal (*Campbell*); 1 ♂, 1 ♀, Madras, Madurai, Alagar Kovil, 17–18.iii.1936 (*BM–CM Expedition*); 1 ♀, Madras, Coonor Ghaut, Burliyar, 3000 ft (1000 m), 17.iv.1937 (*BM–CM Expedition*); 1 ♂, Madras, Biligirirangan Hills, Dhimbam, 29.iv.1937 (*BM–CM Expedition*); 1 ♂, Madras, Coimbatore, Bolamputti Valley, 20.iv.1937 (*BM–CM Expedition*) (all in BMNH, London); 1 ♂, Madras, Coimbatore, 1400 ft (430 m) v.1960 (*P. Susai Nathan*) (RNH, Leiden); 1 ♀, Andhra Pradesh, Krishna, Vijayawada [as Bezwada], 30.xii.1908, on *Cajanus cajan* [as Red Gram] (*T. V. R.*); 1 ♂, Maharashtra, Bombay (ex *Distant* coll.); 2 ♀, Maharashtra, Bombay (*W. Elliott*) (all in BMNH, London); 3 ♀, 'E. Ind.' (*Bacon*) (UM, Oxford).

Clavigralla orientalis sp. n.

(Figs 3, 5, 15, 16)

Length: 7·8–10·0 mm.

Very similar in appearance to *C. gibbosa*. Ratio of lengths of segments of rostrum about 1·00 : 0·96 : 0·66 : 1·17. Pronotum (Figs 3, 5) with posterolateral spines directed laterally or somewhat anterolaterally, rarely angled as far forward as those of *gibbosa*. Paramere (Figs 15, 16) with blade much smaller and narrower than that of *gibbosa*.

REMARKS. Distinguishable from *gibbosa* with certainty only by the shape of the male parameres. Segment III of rostrum generally shorter than in *gibbosa*.

DISTRIBUTION. Two subspecies, one in northern India, Burma and south-east Asia, the other in southern China.

Clavigralla orientalis orientalis subsp. n.

(Figs 3, 15)

Length: ♂, 7·8–8·9 mm, mean 8·5 mm (n = 11); ♀, 8·7–10·0 mm, mean 9·3 mm (n = 14).

Ratio of lengths of antennal segments I : II : III : IV in male about 1·00 : 0·69 : 0·59 : 0·95, in female about 1·00 : 0·71 : 0·59 : 0·93; length of segment I divided by width of head including eyes in male 1·25–1·48, mean 1·34 (n = 12), in female 1·25–1·39, mean 1·30 (n = 14). Pronotum (Fig. 3) with spines of posterolateral angles directed laterally with slight forward curvature, width across tips of spines divided by width of head including eyes in male 2·76–2·94, mean 2·83 (n = 8), in female 2·87–3·17, mean 3·02 (n = 11). Male paramere as in Fig. 15.

REMARKS. Differs from the other subspecies chiefly in its shorter pronotal spines and shorter antennal segment IV.

DISTRIBUTION. Northern India, Burma and Indochina south-eastwards to Java.

MATERIAL EXAMINED. Holotype ♂, INDIA: Uttar Pradesh, Kumaon, S. Garhwal, 2000 m [as 6500 ft] (*H. G. Champion*) (BMNH, London).

Paratypes. INDIA: 1 ♀, Uttar Pradesh, Ranikhet, Bhatkot (*H. G. Champion*); 1 ♀, Uttar Pradesh, Kumaon, Nainital (*H. G. Champion*); 1 ♀, Uttar Pradesh, Chakrata, Jaunsar, v.1929 (*H. G. Champion*); 1 ♂, Bihar, Pusa, 28.vi.1915 (*Govt entomologist*); 1 ♀, Bihar, Shahabad (all in BMNH, London). BURMA: 1 ♂, 1 ♀, Tenass Valley (*Doherty*) (BMNH, London). LAOS: 1 ♀, Borikhame, Pakkading, 15–31.viii.1965 (*native collector*) (BPBM, Honolulu). VIETNAM: 1 ♀,

Tonkin, 1.vi.1908 (*R. V. de Salvaza*) (BMNH, London). THAILAND: 1 ♂; Bangkok, 13.ii.1961, on *Cajanus cajan* (BMNH, London). JAVA: 4 ♂, 2 ♀, Dramaga, Bogor [as Buitenzorg], 17.x.1936 (*J. v. d. Vecht*) (BMNH, London and RNH, Leiden); 2 ♂, 3 ♀, Semarang, 13.viii.1926 (*Fr. A. Th. Verbeek*) (RNH, Leiden and BMNH, London); 1 ♂, 2 ♀, Bogor [as Buitenzorg] 250 m, x.1936, on *Cajanus cajan* (*J. v. d. Vecht*); 1 ♂, Batoerraden, G. Slamet, 800 m, vi.1937 (*F. C. Drescher*); 1 ♀, Djeroeklegi, S. Banjoemas, 29.v.1932 (*F. C. Drescher*) (all in RNH, Leiden).

Clavigralla orientalis serica subsp. n.

(Figs 5, 16)

Length: ♂, 8·8–8·9 mm (n = 2); ♀, 8·6–9·7 mm, mean 9·3 mm (n = 8).

Ratio of lengths of antennal segments I : II : III : IV in male about 1·00 : 0·70 : 0·59 : 1·01, in female about 1·00 : 0·73 : 0·62 : 1·00; length of segment I divided by width of head including eyes in male 1·29–1·31 (n = 2), in female 1·18–1·35, mean 1·26 (n = 7). Pronotum (Fig. 5) with spines of posterolateral angles long, directed laterally or slightly anterolaterally, width across tips of spines divided by width of head including eyes in male 3·15–3·44 (n = 2), in female 3·14–3·52, mean 3·35 (n = 5). Paramere (Fig. 16) very similar to that of subsp. *orientalis*.

REMARKS. Distinguishable from the nominate subspecies by the longer pronotal spines and the longer antennal segment IV. An account of the biology and descriptions of the various stages of the life cycle of this subspecies (under the name of *Clavigralla gibbosa*) are given by Hoffmann (1933), who records it feeding and breeding on *Aeschynomene indica* L. (Leguminosae).

DISTRIBUTION. Southern China.

MATERIAL EXAMINED. Holotype ♂, CHINA: Fukien, Shaowu, Aotow, x.1941 (*T. C. Maa*) (BPBM, Honolulu).

Paratypes. CHINA: 1 ♀, Fukien, Chianglo, 6.ix.1940 (*Maa*); 1 ♀, Fukien, Lo Fou Mountains, Put Wan Tze, 3520 ft (1070 m), 28–29.x.1906 (both in BPBM, Honolulu); 2 ♂, 3 ♀, Fukien, Chung An, Bohea Hills, 23.vii.1939, 31.vii.1939, 6.x.1940 (*Maa*) (BPBM, Honolulu and BMNH, London); 1 ♀, Fukien, Amoy, 1922 (*S. F. Light*); 1 ♀, Kwangtung, P'an-yu District, Honam Island, 7.iv.1935 (*W. E. Hoffmann*) (both in BMNH, London).

Clavigralla scutellaris (Westwood)

(Figs 4, 11, 17, 18, 25)

Coreus scutellaris Westwood, 1842 : 24. LECTOTYPE ♂, INDIA (UM, Oxford), here designated [examined].

Acanthomia brevirostris Stål, 1873 : 82. LECTOTYPE ♀, SUDAN (NR, Stockholm), here designated [examined]. **Syn. n.**

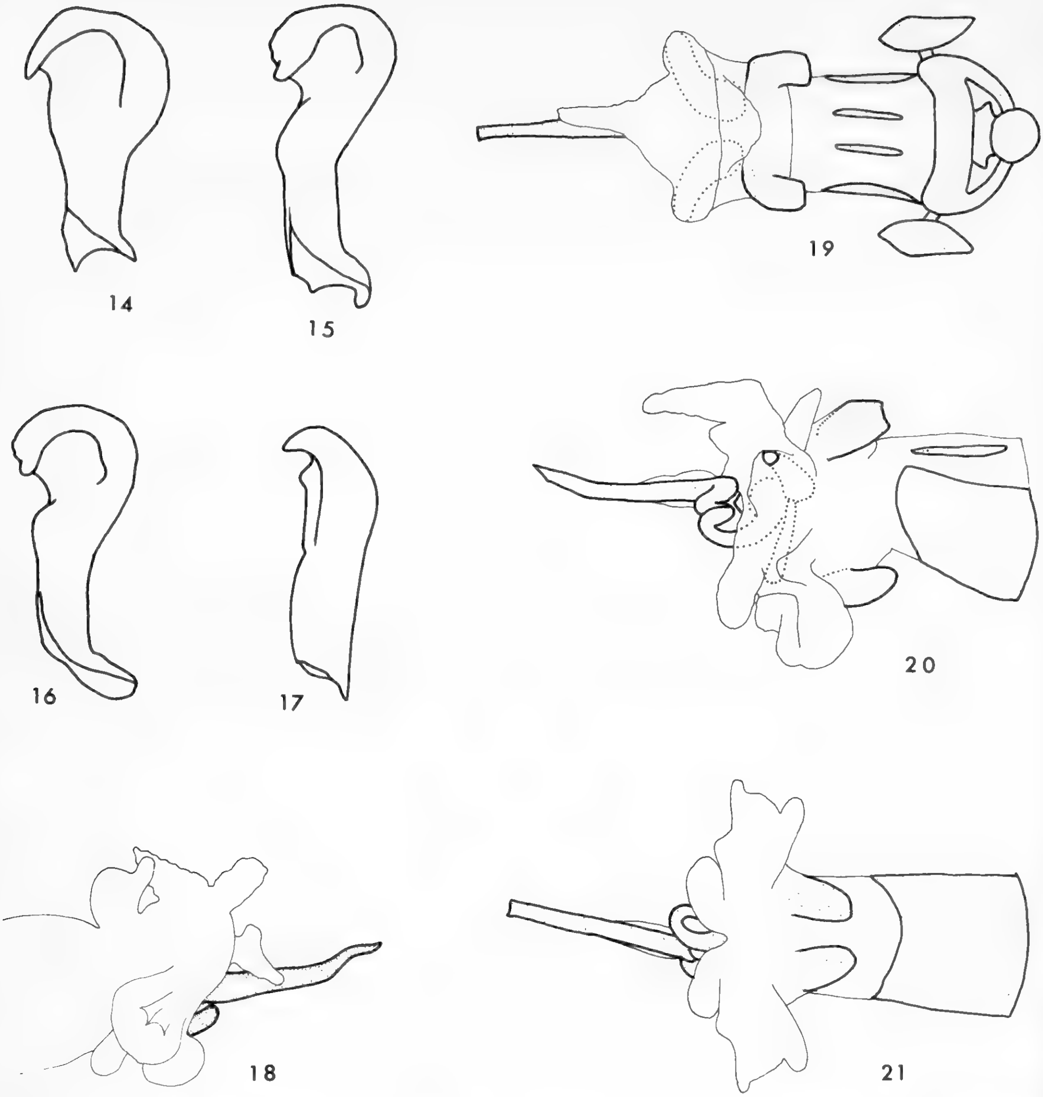
Clavigralla scutellaris (Westwood) Dallas, 1852 : 514.

Length: ♂, 8·7–10·3 mm, mean 9·6 mm (n = 14); ♀, 9·8–12·2 mm, mean 10·8 mm (n = 18).

Antennifers slightly divergent, outer apical angles each with a broad, deflexed process. Ratio of lengths of antennal segments I : II : III : IV in male about 1·00 : 0·84 : 0·71 : 1·04, in female about 1·00 : 0·85 : 0·72 : 0·99; length of segment I divided by width of head including eyes in male 1·18–1·39, mean 1·28 (n = 14), in female 1·15–1·38, mean 1·26 (n = 18). Ratio of lengths of rostral segments I : II : III : IV in both sexes about 1·00 : 0·92 : 0·75 : 1·15.

Pronotum (Fig. 4) generally similar to that of *C. gibbosa*, width across tips of posterolateral spines divided by width of head including eyes in male 2·58–2·97, mean 2·73 (n = 13), in female 2·73–3·12, mean 2·97 (n = 16). Metathoracic peritreme with dorsal ridge about as high as wide, entire. Scutellum strongly convex. Anterior and intermediate femora each with a single, small, subapical spine beneath, posterior femur with spines arranged as in *C. gibbosa*. Posterior tibia slightly curved at base, about three-quarters as long as posterior femur.

Abdominal sterna with posterolateral angles (Fig. 11) slightly prominent. Male genital capsule with lip broad, filling posterior emargination, tongue apically trifid. Paramere (Fig. 17) with blade narrow. Phallotheca consisting of a broad, ventral sclerite produced upwards posterolaterally and two narrow, parallel, longitudinal, dorsal sclerites. Conjunctiva (Fig. 18) with dorsomedian lobe low, flat-topped, bearing a pair of small, membranous appendages at its dorsolateral angles; intermediate dorsal lobe membranous, conical; distal dorsomedian lobe obsolete; distal dorsolateral lobes membranous,



Figs 14–21 *Clavigralla* species. (14) *gibbosa*, dorsomedial view of left paramere; (15) *orientalis orientalis*, same; (16) *orientalis serica* (holotype), same; (17) *scutellaris*, same; (18) *scutellaris*, left lateral view of conjunctiva and vesica; (19) *gibbosa*, entire aedeagus in dorsal view; (20 & 21) *gibbosa*, right lateral and ventral views of phallotheca, conjunctiva and vesica. Dotted lines in Fig. 19 show outline of wings of ejaculatory reservoir complex seen by transparency; dotted lines in Fig. 20 show outline of entire complex seen by transparency. Stipple indicates sclerotized areas.

about twice as long as wide; posterior face of conjunctiva above vesica with a pair of membranous, T-shaped lobes; distal ventrolateral lobes large, lightly sclerotized; ventral lobes rather small, membranous. Ejaculatory reservoir complex symmetrical, wings and straps long. Sclerites protecting base of vesica paired, symmetrical. Female abdominal sternite VII divided for slightly less than half its length. Ovipositor similar to that of *C. gibbosa*. Spermatheca (Fig. 25) with bulb narrow, duct about twice as long as bulb and slightly sinuous.

Sculpture of integument as in *C. gibbosa* except for disc of pronotum which is granulate-punctate with a few of the larger granules on the declivent area projecting through the tomentum.

Distribution and colour of the various types of pubescence as in *C. gibbosa* except that the decumbent pubescence is always silvery white, never with yellowish or golden tinge and junction of areas of pale and

dark pubescence on pronotum follows a weakly undulating line and tufts of brown hairs are absent from this region.

Coloration generally as in *C. gibbosa* but head usually with some dorsal markings piceous and femora and tibiae with incomplete piceous annuli at junctions of reddish brown areas with stramineous areas, tibiae also occasionally with incomplete brown or piceous median annuli. Clavus and corium buff, suffused with pink especially in apical part of corium, granules of basal veins piceous, punctures often brown. Membrane lightly infuscate except for a narrow, colourless or milky band against apical margin of corium. Laterotergites pinkish brown, concolorous or with a small, transversely oval, stramineous spot or band in anterior half of some or all of them.

REMARKS. This species may readily be separated from *C. gibbosa* and *C. orientalis* by the weakly undulating junction between the areas of light and dark pubescence on the pronotum. It is very closely related to *C. tomentosicollis* Stål, a common and widespread pest of pulse crops in the Ethiopian region, and the ranges of the two species are almost contiguous in Africa.

DISTRIBUTION. Occupies a crescent-shaped area from Kenya and Sudan through Arabia and Pakistan to India. This distribution may in part result from human introduction. The specimen listed below from Pakistan is from an area generally regarded as being in the Palaearctic region.

MATERIAL EXAMINED. *Coreus scutellaris* Westwood, lectotype ♂, INDIA: Gogo (UM, Oxford). *Acanthomia brevirostris* Stål, lectotype ♀, SUDAN: Chartum [=Khartoum] (*Schauf*) (NR, Stockholm).

KENYA: 1 ♂, Northern Frontier District, Wajir, 25.i.1955 (*I. Lansbury*); 1 ♂, S. Nyeri, vi.1949 (*van Someren*); 1 ♀, Lukenia, iii.1937 (*van Someren*). SUDAN: 1 ♂, [no locality cited,] 16.iii.1926 (*G. R. F. Medani & F. G. S. Whitfield*); 2 ♀, Berber Prov., Lulua, 1908 (*H. H. King*); 3 ♂, 1 ♀, Ed Damer, 5–10.vii.1961 (*R. Linnavuori*). SOUTHERN YEMEN: 3 ♂, 3 ♀, El Kod, xii.1957, on *Dolichos lablab* (*R. C. M. Darling*); 1 ♀, Wadi Dareija, SW. of Dhala, c. 1400 m, 6–9.xi.1937 (*H. Scott & E. B. Britton*). MUSCAT AND OMAN: 1 ♀, Oman, Al Wafi, 18.iii.1976 (*K. Guichard*). PAKISTAN: 1 ♂, Hangu, 13.x.1963, in flight (*M. N. Zaman*). INDIA: 1 ♂, Andhra Pradesh, Hyderabad, 28.x–4.xi.1971 (*A. C. Pont & J. C. Deeming*); 1 ♀, 1 V instar nymph, Maharashtra, Bombay (*Dixon*); 1 ♂, 1 ♀, Madras, Coimbatore, 3.vii.1914, reared on Red Gram (*Cajanus cajan*) (*Ramakrishna*); 1 ♀, Kerala, Thekkadi, Periyar Dam, 6–10.v.1937 (*BM–CM Expedition*); 1 ♀, 'Trev.' [?=Kerala, Trivandrum], vi.1901; 3 ♂, 6 ♀, Mysore, Chickballapur, ii, iii and vi.1915 (*T. V. Campbell*). (All in BMNH, London.) AFGHANISTAN: 1 ♀, Nengrahar Prov., banks of Kabul River and desert, 580 m, 27.v.1969 (*D. Povolný*) (Moravské Museum, Brno, Czechoslovakia).

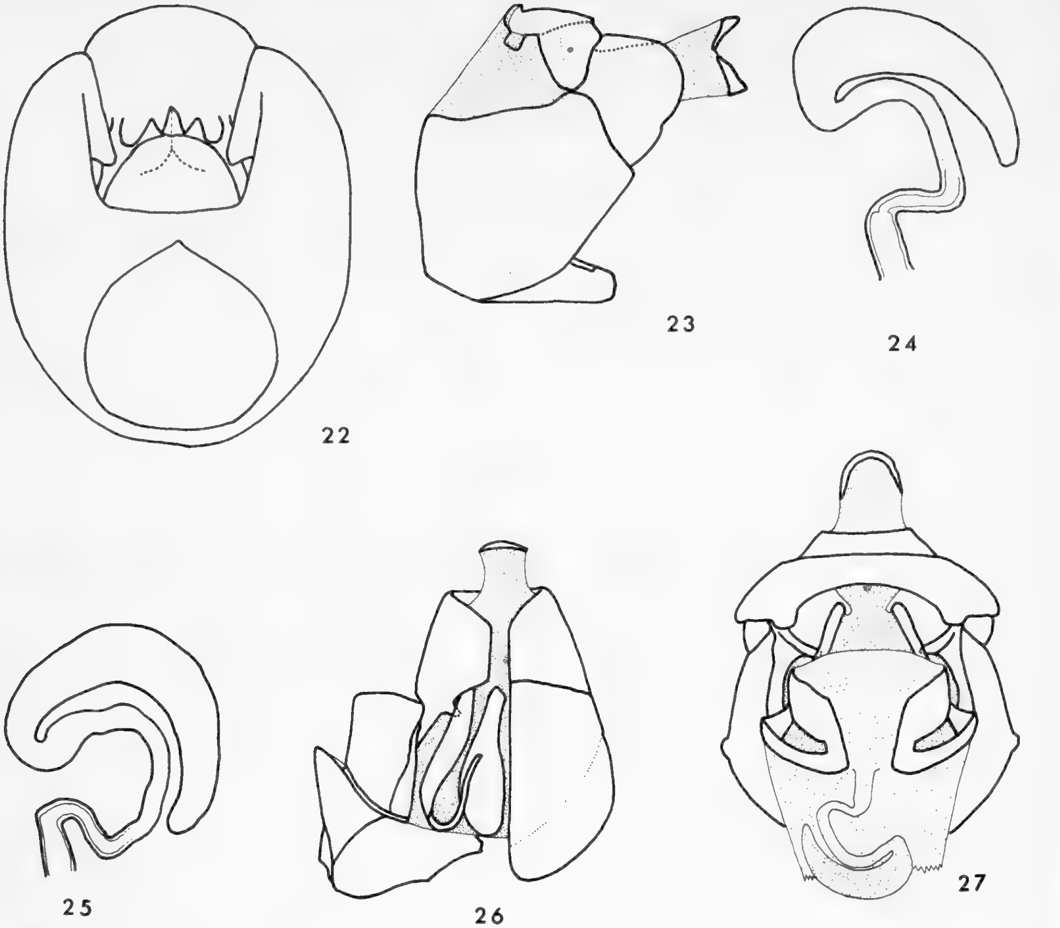
***CLAVIGRALLOIDES* gen. n.**

Type-species: *Lygaeus acantharis* Fabricius, 1803.

Form oblong, rather robust, not depressed, connexivum broadest in middle, aspect spinose.

Head between one-half and two-thirds length of pronotum, granulate. Antennifers parallel or slightly divergent, process at outer apical angle either very short or long and narrow, not touching maxillary plate. Antennae with segment I the longest, about one and a half times as long as width of head including eyes, of uniform width from near base to apex, weakly granulate; segment II longer than III, both very weakly granulate and more slender than I; segment IV elongate fusiform, sensory area occupying about 93 per cent of its length. Rostrum reaching disc of metasternum, segment I the longest, II and IV slightly shorter than I, subequal, III slightly longer than half length of I. Bucculae occupying about one-quarter to one-third of length of ventral midline of head.

Pronotum strongly declivent, posterolateral angles produced, each bearing a strong spine, posterior margin in front of scutellum straight, prescutellar angles each marked by a short spine, disc always bearing four short, stout spines, the anterior pair larger and more widely spaced than the posterior pair, lateral margins, posterolateral margins and anterior part of disc strongly granulate, disc posteriorly punctate. Scutellum longer than wide, convex, apex very slightly produced, pointed. Mesosternum and metasternum broadly sulcate in midline. Metapleural scent-gland orifice with dorsal ridge of peritreme bilobed, posterior lobe much smaller than anterior, or very rarely entire. Corium with apex slightly produced, reaching suture between laterotergites V and VI when at rest. Wings with antevannal vein well developed. Anterior and intermediate femora each with a single, moderately large, ventral, subapical spine, occasionally with a very small spine distal to this. Posterior femora with two major spines in the subapical



Figs 22–27 *Clavigralla* species. (22) *gibbosa*, dorsal view of genital capsule with parameres removed; (23) *gibbosa*, left lateral view of structures of ♀ abdominal segments VIII–XI; (24) *gibbosa*, spermatheca; (25) *scutellaris*, same; (26) *gibbosa*, ventral view of structures of ♀ abdominal segments VIII–XI; (27) *gibbosa*, dorsal view of structures of abdominal segments VIII–XI. Fine dotted line across paratergite VIII and valvifer I in Figs 23 and 26 indicates limit of area normally retracted into segment VII; thick dotted lines in Fig. 23 demarcate terga and paratergites of segments VIII and IX. Stipple indicates membrane; sparse stipple in Fig. 27 indicates common oviduct and gynatrial sac.

series, some small or very small spines between them, rarely one very small spine proximal to the first major spine and close to it, and a terminal series of three or four spines.

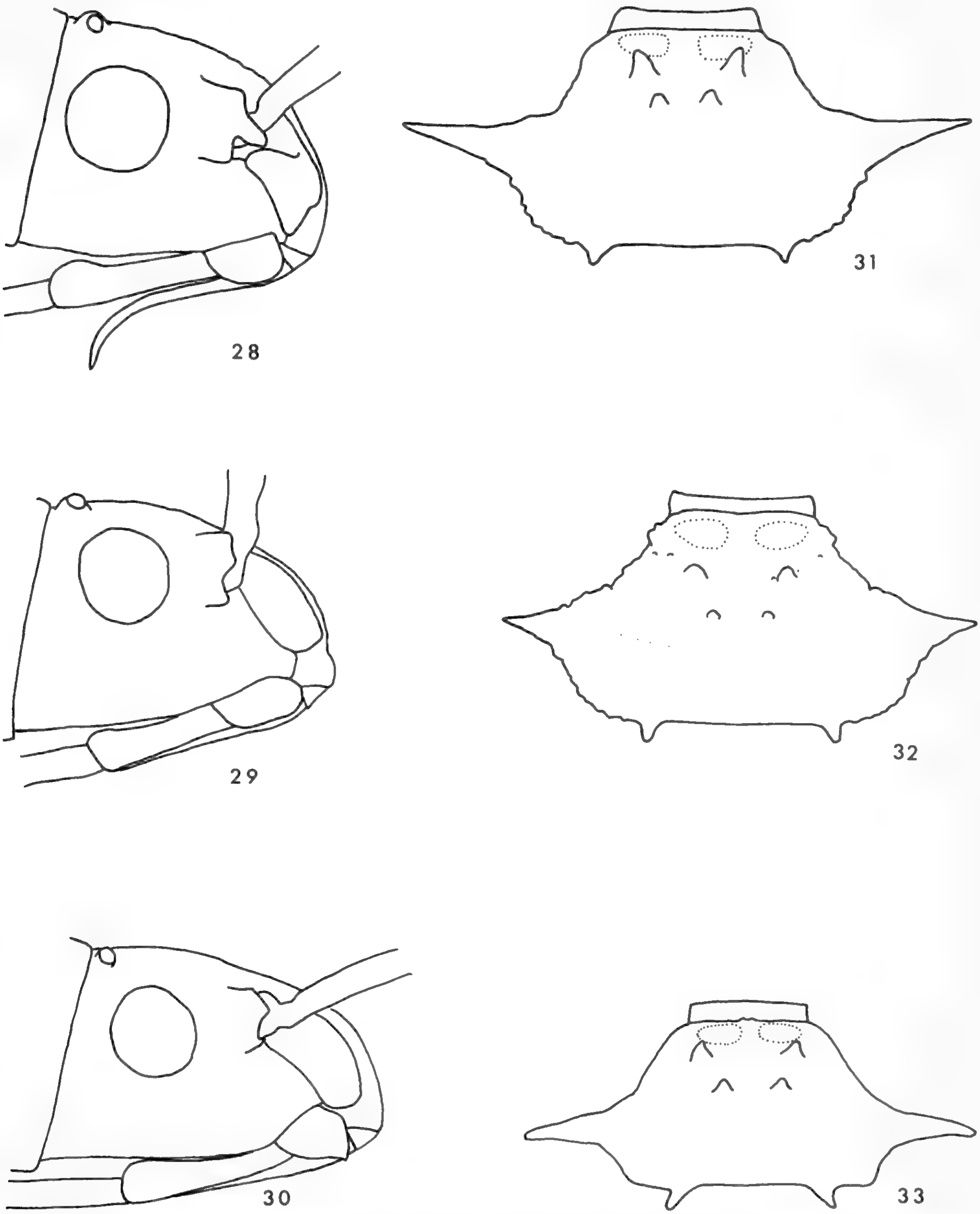
Abdominal sterna III–VII with posterolateral angles produced into spines.

Male genital capsule with lip narrow, apices of parameres visible in posterior view on each side of lip, tongue of capsule long and rather narrow. Phallotheca with a large, ventral sclerite extended dorsolaterally and two narrow, parallel, dorsal sclerites. Conjunctiva with two sclerites protecting base of vesica, the left one slightly the larger, otherwise membranous, with narrow dorsomedian lobe, with or without narrow distal dorsomedian lobe, with finger-like distal dorsolateral lobes, small, rounded, apical ventral lobes and large, multifid distal ventolateral lobes. Ejaculatory reservoir complex with straps minute, rudimentary, wings penetrating bases of distal dorsolateral lobes for a short distance.

Spermatheca with bulb narrowly lunate, duct less than twice as long as bulb and attached terminally or subterminally to it. Second valvula of ovipositor internally with a ventrodistally projecting, setose, membranous lobe. Sclerites of anterior wall of gynatrium with three short arms. Female tergum IX in same plane as rest of abdominal tergites, anus directed posteriad.

REMARKS. Differs from other genera of Clavigrallini in the characteristic arrangement of spines on the disc of the pronotum. Because both primitive and derived forms of antennifer process and metathoracic peritreme occur, the genus appears to be of comparable age to the tribe.

DISTRIBUTION. Northern India and southern China south-eastwards to New Guinea and northern Australia.



Figs 28–33 *Clavigralloides* species. (28) *acantharis*, right lateral view of head; (29) *tuberosus tuberosus*, same; (30) *enkidu* (holotype), same; (31) *acantharis*, dorsal view of pronotum; (32) *tuberosus tuberosus*, same; (33) *enkidu* (holotype), same.

Key to species

1 Process at outer angle of antennifer short (Figs 29, 30) 2
– Process at outer angle of antennifer long, narrow (Fig. 28) 4
2 Metathoracic peritreme with dorsal ridge entire (Fig. 38). Pronotum with white, decumbent pubescence throughout. (New Guinea) . . . . ***C. enkidu*** sp. n. (p. 300)
– Metathoracic peritreme with dorsal ridge bilobed (as in Fig. 37). Pronotum with pubescence white anteriorly, brown posteriorly. (S. China, N. India) (***C. tuberosus*** Hsiao) 3
3 Pronotum with posterolateral angles directed laterally (Fig. 32). (S. China) ***C. tuberosus tuberosus*** (Hsiao) (p. 303)
– Pronotum with posterolateral angles directed anterolaterally (Fig. 34). (N. India) ***C. tuberosus indicus*** subsp. n. (p. 303)
4 Pronotum with posterolateral spines short (Fig. 35). (Lombok, Timor, Tukang Besi Islands) ***C. quadrituberculatus*** (Breddin) (p. 300)
– Pronotum with posterolateral spines longer (Figs 31, 36) 5
5 Paramere with blade narrow (Figs 44–46). Abdomen with marginal spines narrower (Fig. 39). (China, SE. Asia to Australia) . . . . ***C. acantharis*** (Fabricius) (p. 296)
– Paramere with blade broad (Figs 47, 48). Abdomen with marginal spines broader (Fig. 40). (New Guinea, Australia) . . . . ***C. spinosus*** sp. n. (p. 297)

Descriptions of species

Clavigralloides acantharis (Fabricius) comb. n.

(Figs 28, 31, 37, 39, 44–46, 53, 55, 58, 61, 62)

Lygaeus acantharis Fabricius, 1803 : 206. LECTOTYPE ♂, China (UZM, Copenhagen), here designated [examined].

Clavigralla tuberculata Dallas, 1852 : 513. Holotype, Hong Kong (BMNH, London) [examined]. [Synonymized by Distant, 1901 : 426.]

Clavigralla acantharis (Fabricius) Stål, 1868 : 67.

Clavigralla spinigera Walker, 1872 : 6. Holotype ♂, West Malaysia (BMNH, London) [examined]. **Syn. n.**

Length: ♂, 8·3–9·9 mm, mean 9·2 mm (n = 18); ♀, 8·8–10·4 mm, mean 9·8 mm (n = 29).

Ratio of lengths of antennal segments I : II : III : IV about 1·00 : 0·85 : 0·77 : 0·81. (In eight specimens from China, included in these figures, the average ratio is 1·00 : 0·82 : 0·74 : 0·81). Length of segment I divided by width of head including eyes 1·41–1·86, mean 1·61 (n = 48). Bucculae rounded, occupying between one-quarter and one-third length of ventral midline of head. Ratio of lengths of rostral segments I : II : III : IV about 1·00 : 0·93 : 0·54 : 0·91, but length of IV variable, sometimes longer than II. Antennifers slightly divergent, outer apical angle of each bearing a narrow, obliquely deflexed process (Fig. 28). Pronotum (Fig. 31) with posterolateral spines directed laterally or slightly anterolaterally, width across tips of spines divided by width of head including eyes 3·00–3·37, mean 3·31 (n = 42), area of disc bearing the four spines distinctly convex. Metathoracic scent-gland peritreme with anterior and posterior lobes of dorsal ridge distinct (Fig. 37). Abdominal sternites III–VII with posterolateral angles produced into rather long spines (Fig. 39). Male genital capsule apically notched or sometimes entire. Paramere (Figs 44–46) rather slender, with shaft tapering slightly towards base, apical margin with or without a slight notch. Conjunctiva (Fig. 53) without prominent distal dorsomedian lobe, distal dorsolateral lobes joined dorsally by a low fold. Female second valvulae (Fig. 55) oblong, bilobed apically, upper lobe sclerotized and glabrous, lower lobe membranous and setose. Sclerites of anterior wall of gynatrium as in Figs 61 and 62. Spermatheca (Fig. 58) with duct attached terminally to bulb.

Thoracic pleura granulate-punctate, sterna with reticulate sculpture; femora very weakly granulate; clavus with three rows of punctures, corium seriately punctate, more deeply so anteriorly, main veins of corium granulate basally. Abdominal terga I and II transversely rastrate, III–VI punctate, the punctures very large and occasionally confluent on anterior tergites, becoming much smaller and more remote posteriorly; abdominal sterna and laterotergites weakly granulate.

Head and antennae with short, semi-erect pubescence, head and antennal segment I with decumbent, white, tomentose pubescence. Pronotum, scutellum and thoracic pleura with both types of pubescence throughout, the white, decumbent type particularly dense in three longitudinal lines on pronotum, along midline and sides of scutellum and in several oblique lines on pleura; thoracic sterna with decumbent, tomentose pubescence only. Legs with long, erect and shorter, semierect hairs, femora also with patches of sparse, decumbent, white pubescence. Clavus and corium with uniform, rather short, semidecumbent pale

brown pubescence. Abdominal sterna with longer and shorter semierect hairs and numerous small patches of white, decumbent pubescence, these patches confluent and more dense towards sides of sternites II and III. Laterotergites with decumbent, white pubescence and short, semidecumbent pubescence.

Colour generally reddish brown, spines of pronotum, of femora and of abdominal sternites piceous; clavus, corium, antennae, tibiae, tarsi and basal half of femora stramineous; hemelytral membrane with veins brown; apex of scutellum, a large patch in middle of laterotergites VI and VII, much of female genitalia and two rows of oblique stripes on each side of abdominal sternites III–VII pale yellow.

REMARKS. There is some variation between populations in respect of the relative lengths of the antennal segments and in the male genitalia, which in some populations or individuals display a small apical notch in both the posterior border of the lip of the genital capsule and the apical margins of the parameres. There is also slight variation in the width of the blade of the paramere. These differences do not seem sufficiently marked to justify delineation of subspecies. The species is characterized by the long, narrow process of the antennifer and the long abdominal spines.

DISTRIBUTION. This species is found throughout almost the whole range of the genus, from southern China, through the mainland and islands of south-east Asia to New Guinea and the extreme north of Australia.

MATERIAL EXAMINED. *Lygaeus acantharis* Fabricius, lectotype ♂, CHINA (*Pflug*) (Fabricius's collection, now at UZM, Copenhagen). *Clavigralla tuberculata* Dallas, holotype [abdomen missing, probably ♀], HONG KONG (BMNH, London). *Clavigralla spinigera* Walker, holotype ♂, WEST MALAYSIA: Penang (*Bowring*) (BMNH, London).

CHINA: 1 ♂, Foochow, 1937–1938 (*M. S. Yang*) (BMNH, London); 1 ♀, Fukien, Chung An, Bohea Hills, 24.vi.1939 (*T. C. Maa*); 1 ♀, Bohea Hills, 4.vii.1939 (*Maa*); 1 ♂, Bohea Hills, 25.ix.1939 (*Maa*); 1 ♀, Fukien, Shaowu, Ta Chu Lan, ix.1939 (*Maa*); 1 ♀, Shaowu, Shui Pei Kai, vii.1942 (*Maa*) (all in BPBM, Honolulu). LAOS: 1 ♂, 1 ♀, Khammouane Province, Phon Tiou, 11.ix.1965 (*native collector*); 1 ♂, Borikhame Province, Pakkading, 15–31.viii.1965 (*native collector*) (both in BPBM, Honolulu). VIETNAM: 1 ♀, Karyu Dinar, 200 m, 13–28.ii.1961 (*N. R. Spencer*) (BPBM, Honolulu). THAILAND: 1 ♀ (*Saunders*) (BMNH, London). BURMA: 1 ♂, Mishmi Hills, Dingliang, 2450 ft (750 m), 13.iii.1935 (*M. Steele*); 1 ♀, Carin Chebâ, 900–1100 m, 5.xii.1888 (*L. Fea*) (both in BMNH, London). PHILIPPINES: 3 ♀, Luzon, Ripang, 1500 ft (460 m) (*G. Böttcher*); 2 ♀, L., Gabugao, 1550 ft (475 m) (*Böttcher*); 1 ♂, L., Cretas Novi (*W. Schulze*) (all in BMNH, London); 1 ♂, L., Rizal, Montalban, Wa-wa Dam, 150–200 m, 24.iii.1965 (*L. M. Torrevillas*) (BPBM, Honolulu); 1 ♂, Mindanao, Zamboanga (*Böttcher*) (BMNH, London); 1 ♂, M., Agusan, S. Francisco, 10 km SE., 13.xi.1959 (*L. W. Quate*) (BPBM, Honolulu); 1 ♀, Palawan, Brooke's Point, Macagua, 75 m, 27–31.iii.1962 (*H. Holtmann*) (BPBM, Honolulu). BORNEO: 1 ♀, Brunei, Sinaut, 24.xi.1969 (*M. Smart*) (BMNH, London); 1 ♂, 1 ♀, Sarawak, Nanga Pelagus, nr Kapit, 180–585 m, 7–14.viii.1958, secondary forest (*T. C. Maa*) (BPBM, Honolulu). SUMATRA: 1 ♂, Serdang tet, Tobameer (*Dr B. Hagen*) (RNH, Leiden); 1 ♂, Soekaranda, i.1894 (*Dohrn*) (IZPAN, Warsaw). JAVA: 1 ♂ (*Kalshoven*); 2 ♀, Samarang, vii.1909 and ix.1909 (*E. Jacobson*) (all in RNH, Leiden). NEW GUINEA: 1 ♀, Irian Barat, Wamena, 700 m, 10–25.ii.1960 (*T. C. Maa*); 1 ♂, I.B., Genjam, 40 km W. of Hollandia, 100–200 m, 1–10.iii.1960 (*Maa*) (both in BPBM, Honolulu); 2 ♀, Papua New Guinea, Wau, Morobe District, 1200 m, 29–30.ix.1963, at m. v. light-trap (*J. Sedlacek*); 1 ♂, P. N. G., Central District, Sogeri, 600 m, 27.x–8.xi.1968 (*Tawi, Mena*) (all in BPBM, Honolulu); 1 ♂, 1 ♀, P. N. G., Western District, Oriomo Agricultural Station, 13.x.1960, on *Pueraria phaseoloides* (*J. J. H. Szent-Ivany*) (BMNH, London). BISMARCK ARCHIPELAGO: 2 ♂, 4 ♀, New Britain, Gazelle Peninsula, Bainings, St Paul's, 350 m, 4–7.ix.1955 (*J. L. Gressitt*) (BPBM, Honolulu). AUSTRALIA: 1 ♂, Northern Territory, Darwin, Mitchell Street, Mrs Eddy's garden, 6.i.1961 (*G. F. Gross*) (SAM, Adelaide).

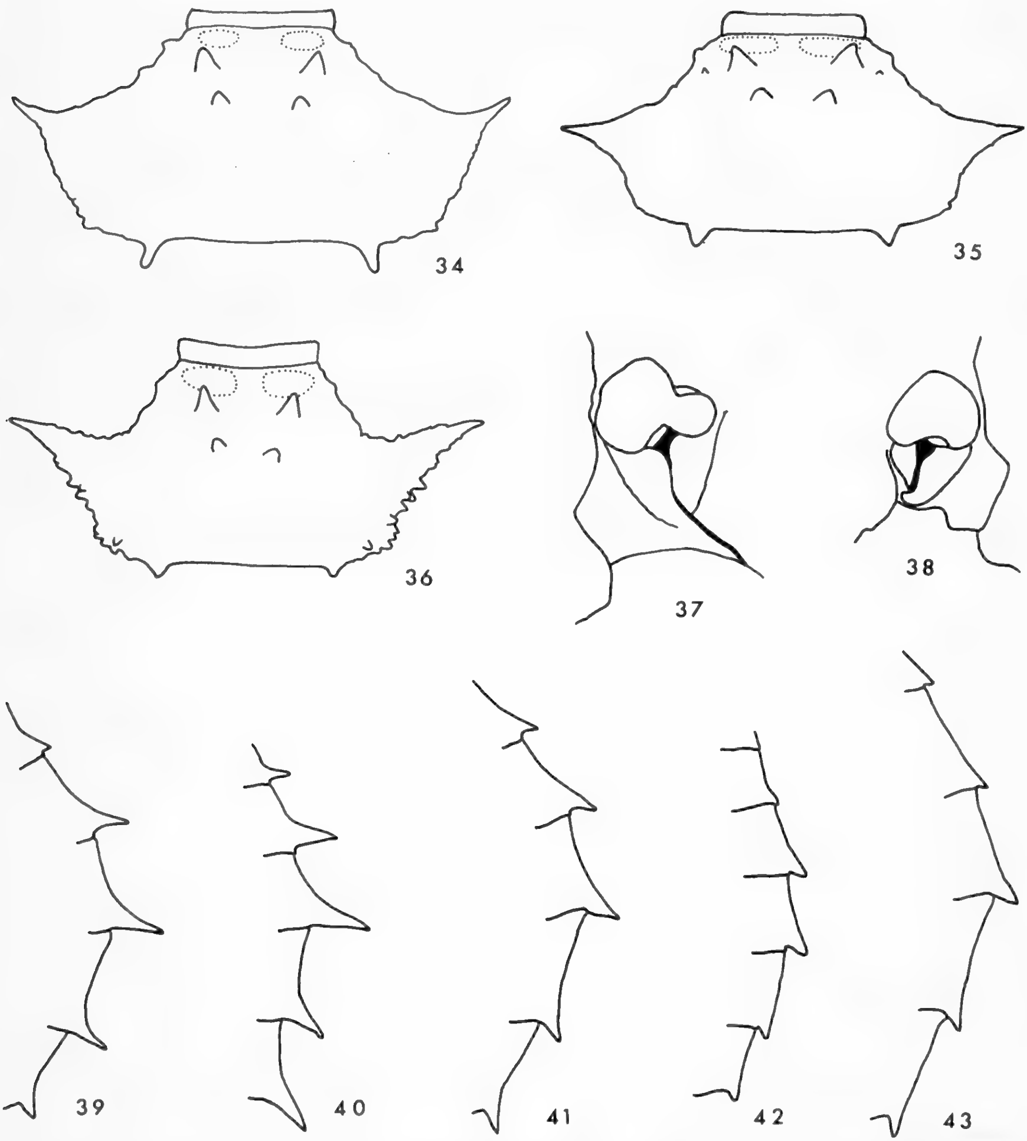
Clavigralloides spinosus sp. n.

(Figs 36, 40, 47, 48)

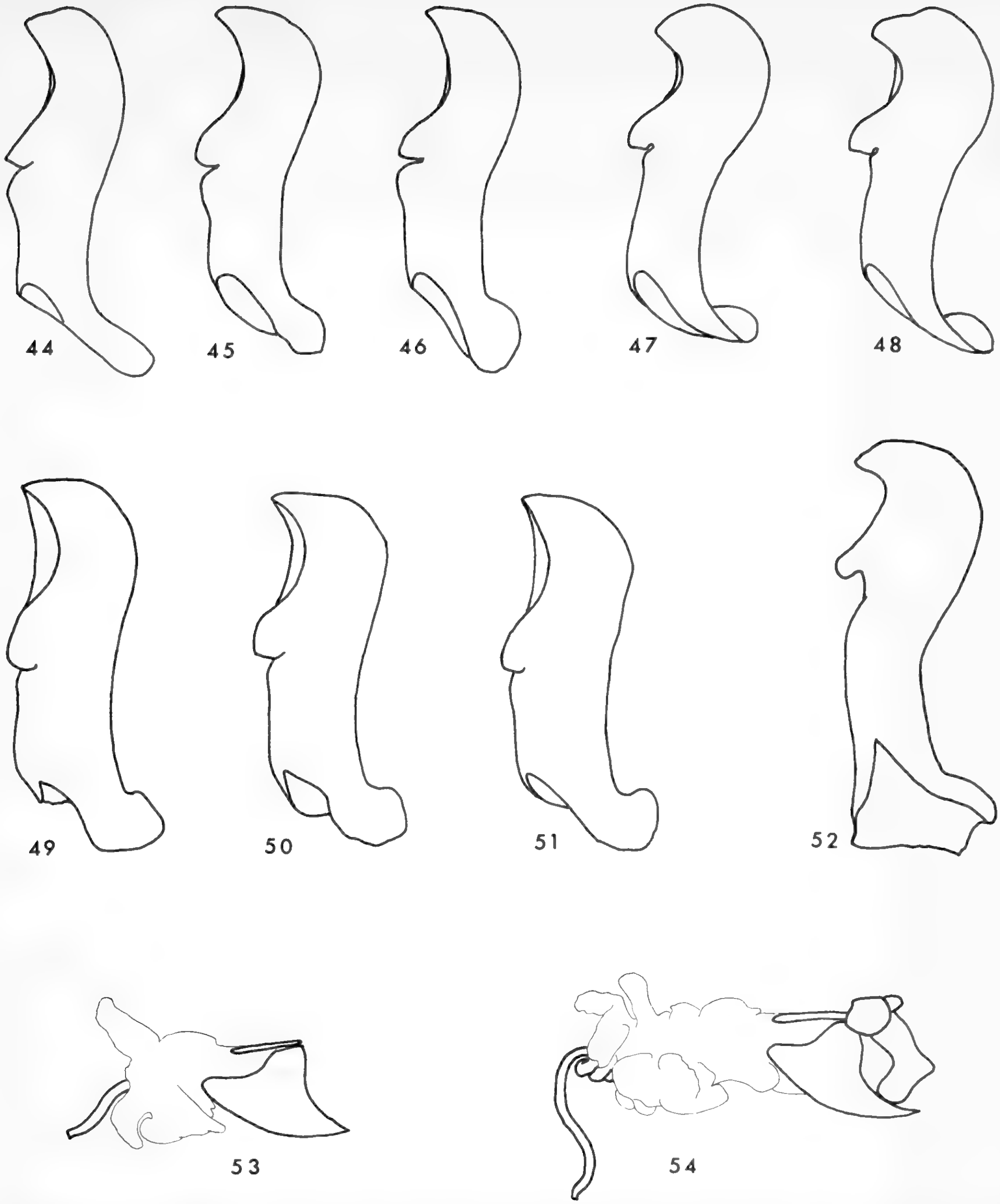
Length: ♂, 8·8–10·0 mm, mean 9·3 mm (n = 5); ♀ unknown.

Similar to *C. acantharis* except as noted here. Ratio of lengths of antennal segments I : II : III : IV about 1·00 : 0·87 : 0·77 : 0·68 in examples from New Guinea, 1·00 : 0·93 : 0·85 : 0·72 in examples

from Australia. Length of segment I divided by width of head including eyes 1·50–1·86, mean 1·75 (n=5), shortest in Australian examples. Ratio of lengths of rostral segments I : II : III : IV about 1·00 : 0·94 : 0·54 : 0·91. Antennifers as in *C. acantharis*. Pronotum (Fig. 36) with posterolateral spines directed obliquely forwards in Australian and in three New Guinean examples, directed laterally in the fourth New Guinea example, width across tips of posterolateral spines divided by width of head including eyes 2·86–3·26, mean 3·08 (n=5). Metathoracic peritreme with dorsal ridge less strongly bilobed than in *C. acantharis*. Abdominal sternites III–VII (Fig. 40) produced posterolaterally into spines stouter than those of *C. acantharis*. Male genitalia as in *C. acantharis* except for paramere (Figs 47, 48), in which the blade is much broader and more strongly curved, with or without apical notch.



Figs 34–43 *Clavigralloides* species. (34) ***tuberosus indicus***, dorsal view of pronotum; (35) ***quadrituberculatus*** (lectotype), same; (36) ***spinosus***, same; (37) ***acantharis***, lateral view of left metathoracic peritreme; (38) ***enkidu*** (holotype), lateral view of right metathoracic peritreme; (39) ***acantharis***, ventral view of left margin of abdomen; (40) ***spinosus***, same; (41) ***quadrituberculatus*** (lectotype), same; (42) ***enkidu*** (holotype), same; (43) ***tuberosus tuberosus***, same.



Figs 44–54 *Clavigralloides* species. (44) *acantharis* (China), dorsomedial view of left paramere; (45) same (Philippines: S. Mindanao); (46) same (New Guinea); (47) *spinosus* (New Guinea), same; (48) same (Australia); (49) *quadrituberculatus* (lectotype), same; (50) same (Tukang Besi Is); (51) same (Timor); (52) *tuberosus tuberosus*, same; (53) *acantharis*, right lateral view of phallotheca, conjunctiva and vesica; (54) *tuberosus tuberosus*, right lateral view of entire aedeagus.

Sculpture of integument as in *C. acantharis* except that granulation of pronotum posteriorly is much more pronounced. Pilosity distributed as in *C. acantharis* but tomentose pubescence less dense, forming a distinct pale line only along midline of scutellum and, less distinctly, along midline of pronotum; large, pale patches of pubescence on pleura and abdominal sterna II and III ill-defined. Colour dark red-brown, with paler areas in the same positions as in *C. acantharis* but these areas pale red-brown, not contrasting strongly with darker areas.

REMARKS. This species is apparently closely related to *C. acantharis*, differing most in the shape of the male paramere. It may be recognized by the long, narrow process of the antennifer and the long, stout abdominal spines.

DISTRIBUTION. A rarely encountered species, known only from New Guinea (Papua) and Australia (Queensland).

MATERIAL EXAMINED. Holotype ♂, NEW GUINEA: Papua New Guinea, Dogura, 7.x.1955 (*E. L. Cassidy*) (BPBM, Honolulu).

Paratypes. NEW GUINEA: 3 ♂, Papua New Guinea, Dogura, 23.ix.1955, 1.x.1955 and 7.x.1955 (*Cassidy*) (BPBM, Honolulu and BMNH, London). AUSTRALIA: 1 ♂, Queensland, 32–40 km N. of Cookstown, 27.i.1964 (*J. Sedlacek*) (BPBM, Honolulu); 1 ♂, Q., West Normanby R., 40 miles W. of Cookstown, 12.xi.1965 (*G. Monteith*) (UQ, Brisbane).

Clavigralloides quadrituberculatus (Breddin) **sp. rev., comb. n.**

(Figs 35, 41, 49–51, 57, 59, 63, 64)

Clavigralla quadrituberculata Breddin, 1899 : 171. LECTOTYPE ♂, LOMBOK (IP, Eberswalde), here designated [examined].

[*Clavigralla acantharis* (Fabricius); Bergróth, 1913 : 155. *Clavigralla quadrituberculata* Breddin incorrectly synonymized with *Clavigralla acantharis* (Fabricius).]

Length: ♂, 8·8–10·3 mm, mean 9·75 mm (n = 39); ♀, 9·7–10·8 mm, mean 10·3 mm (n = 61).

Similar to *C. acantharis* but more robust. Ratio of lengths of antennal segments I : II : III : IV about 1·00 : 0·87 : 0·80 : 0·75. Length of segment I divided by width of head including eyes 1·37–1·57, mean 1·46 (n = 10). Antennifers as in *C. acantharis*. Ratio of lengths of rostral segments I : II : III : IV about 1·00 : 0·94 : 0·55 : 0·91. Pronotum (Fig. 35) with posterolateral spines directed laterally, much shorter than those of *C. acantharis* but pronotum itself more robust, so that width across tips of spines divided by width of head including eyes is only slightly less at 2·83–3·18, mean 2·99 (n = 10). Metathoracic scent gland peritreme with dorsal ridge strongly bilobed. Abdominal sternites III–VII with posterolateral angles produced into short spines (Fig. 41). Male genitalia similar to those of *C. acantharis* except for parameres (Figs 49–51) which are slightly broader with the shafts not tapering basally. Female with second valvula (Fig. 57) and spermatheca (Fig. 59) very similar to those of *C. acantharis* but sclerites of anterior wall of gynatrium (Figs 63, 64) with posterior arm twisted.

Sculpture of integument as in *C. acantharis*. Distribution of pubescence also as in that species but decumbent, white pubescence more uniform, conspicuously denser only on midline of scutellum. Colour pattern as in *C. acantharis* but with less contrast between pale and dark areas, the overall effect of colour and pubescence combined being noticeably more drab.

REMARKS. This species is distinguished from other species of the genus by the narrow antennifer process and short abdominal spines. It is closely related to *C. acantharis*.

DISTRIBUTION. Lesser Sunda Islands between Wallace's and Weber's lines.

MATERIAL EXAMINED. *Clavigralla quadrituberculata* Breddin, lectotype ♂, LOMBOK: Sapik, 2000 ft (610 m), v–vi.1896 (*H. Fruhstorfer*) (IP, Eberswalde).

TUKANG BESI ISLANDS: 1 ♂, Binongka I., 7–10.iv.1930 (*Snellius Expedition*) (RNH, Leiden). TIMOR: 33 ♂, 46 ♀, 1 ex. without abdomen, Soeai, iv.1929 (*E. le Moult*); 3 ♂, 8 ♀, Soeai, vi.1929 (*le Moult*); 1 ♂, 8 ♀, 1 ex. without abdomen, Soeai, no date (*le Moult*) (RNH, Leiden and BMNH, London).

Clavigralloides enkidu **sp. n.**

(Figs 30, 33, 38, 42)

Length: ♀, 8·75 mm (n = 1); ♂ unknown.

Similar in build to *C. acantharis* but smaller and darker. Head about three-quarters length of pronotum, its median length almost equal to its width including eyes and thus relatively longer than in other species of the genus. Ratio of lengths of antennal segments I : II : III : IV as 1·00 : 0·98 : 0·93 : 0·67. Length of segment I only 1·26 times width of head including eyes. Antennifers slightly divergent, outer apical angle bearing only a short, porrect, triangular process (Fig. 30). Ratio of lengths of rostral segments I : II : III : IV as 1·00 : 0·93 : 0·53 : 0·83. Bucculae (Fig. 30) acutely angulate anteriorly. Pronotum

(Fig. 33) with posterolateral spines directed laterally with slight curvature posterolaterally. Metathoracic scent-gland peritreme (Fig. 38) with dorsal ridge entire. Abdominal sternites III–VII with posterolateral angles produced into short, triangular spines (Fig. 42). Genitalia not dissected.

Sculpture of integument differs from that of *C. acantharis* in less distinct granulation of dorsal surface of head and obsolescent puncturation of corium. Distribution of types of pubescence as in *C. acantharis*; pale rows of dense, white, decumbent pubescence particularly conspicuous on midline and sides of scutellum, less so on pronotum. Semidecumbent pubescence of corium denser than in *C. acantharis*, these hairs and those of clavus silvery, crisped and flattened. Head pale brown, slightly darker near ocelli, piceous beneath, antennae stramineous with minute, granular hair-bases brown. Pronotum dark brown, scutellum and thoracic pleura mid-brown, thoracic sterna piceous. Legs stramineous, anterior and intermediate femora with a sprinkling of small, piceous spots; posterior femora with a few spots in basal half piceous, posterior face of apical half almost entirely piceous, dorsal side and anterior face pale brown with stramineous patches and small, piceous spots. Anterior and intermediate tibiae each with a short, dorsal streak at base, a penannular mark near base and a few hair-bases at midpoint of its length piceous, posterior tibia with penannular marks at and near base, at middle and near apex piceous. Clavus mid-brown; corium mid-brown darkening apically to piceous, with an arc running from a point three-quarters of the way along costal margin to a point half-way along apical margin and thence along apical margin to its junction with clavus white. Membrane infumate, veins darker brown. Abdominal sternites largely stramineous, sternites II and III piceous close to posterior coxae, IV, V and VI each with a patch of small, piceous spots about half-way between midline and lateral margin, posterolateral angles of IV–VII with extreme apices brown. Laterotergites III–V piceous, a small spot on lateral margin of each near anterior margin stramineous, VI piceous with a broad, oblique band stramineous, VII stramineous with anterior margin piceous, genital segments stramineous; terga piceous, VI and VII with obscure paler markings.

REMARKS. This species is unique in the genus in both the angulate bucculae and the entire dorsal ridge of the metathoracic peritreme. The colour pattern is striking, the white mark at the apex of each corium standing out in sharp contrast to the dark background. The slightly retrorse curvature of the pronotal posterolateral spines is not found in any other species of the genus. The very short external process of the antennifer suggests a relationship with *C. tuberosus*, but the patterns of pubescence, especially on the pronotum, differ widely.

DISTRIBUTION. Known only from the type-locality in New Guinea (Papua).

MATERIAL EXAMINED. Holotype ♀, NEW GUINEA: Papua New Guinea, Vanapa River, 29.ii.1964 (*J. Sedlacek*) (BPBM, Honolulu).

Clavigralloides tuberosus (Hsiao) **comb. n.**

(Figs 29, 32, 34, 43, 52, 54, 56, 60, 65, 66)

Clavigralla tuberosa Hsiao, 1964 : 252, 259, fig. 2. Holotype ♂, CHINA: Fukien, 900 m, 10.viii.1960 (Institute of Zoology, Academia Sinica, Peking) [not examined].

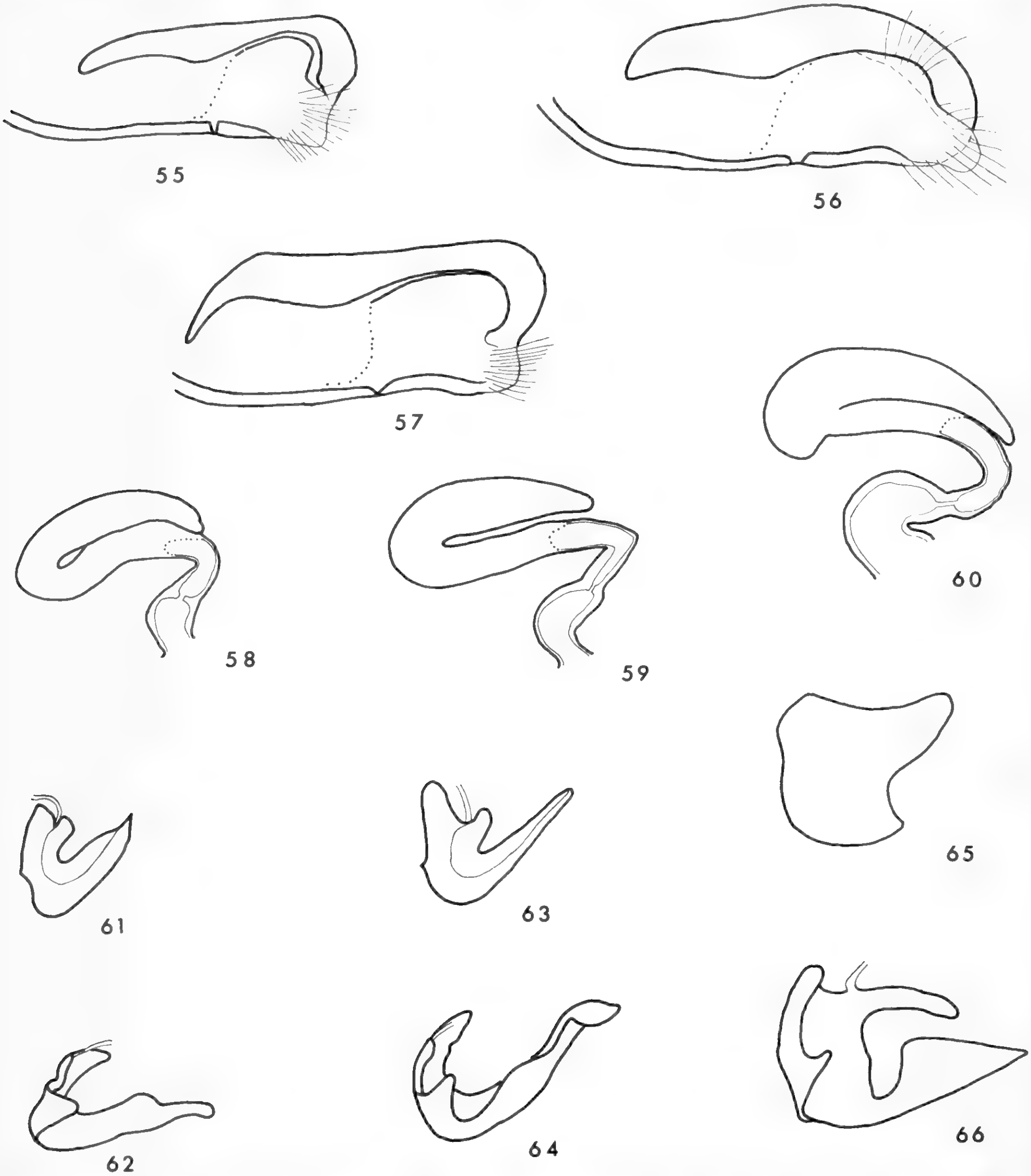
Antennifers parallel, outer apical angle of each with only a short, rounded projection (Fig. 29). Bucculae rounded, occupying less than one-third of ventral midline of head. Ratio of lengths of rostral segments I : II : III : IV about 1·00 : 0·88 : 0·53 : 0·87. Pronotum (Figs 32, 34) rather shallowly declivent, area of disc bearing the four spines weakly convex, spines themselves short, posterolateral spines short, directed laterally or anterolaterally. Metathoracic peritreme with anterior and posterior lobes of dorsal ridge sharply distinct. Abdominal sternites III–VII with posterolateral angles produced into short, triangular spines (Fig. 43). Male genital capsule with lip entire, parameres (Fig. 52) with blade broad. Conjunctiva (Fig. 54) with distal dorsomedian lobe. Female second valvula (Fig. 56) with lower, membranous lobe narrowly produced. Spermatheca (Fig. 60) with duct attached subterminally to bulb. Sclerites of gynatrial wall (Figs 65, 66) of characteristic shape.

Sculpture of integument as in *C. acantharis*.

Head, antennae and legs with pubescence similar to that of *C. acantharis*. Pronotum, except for the area posterior to a line connecting posterolateral angles, with long, erect, pale brown pubescence and shorter, decumbent, silvery, slightly tomentose pubescence, the latter organized, at least anteriorly, into one to three more or less distinct, narrow, longitudinal lines; posterior band of pronotum with short, erect, dark brown pubescence only, the absence of admixed silvery hairs from this band making it appear darker than rest of pronotum, the pale and dark areas sharply demarcated along an almost straight transverse line. Thoracic pleura and abdominal sterna with erect, colourless pubescence and decumbent,

silvery, tomentose pubescence not organized into patches of varying density, but numerous small, circular areas of abdominal sternites devoid of tomentose pubescence altogether. Thoracic sterna with decumbent, silvery pubescence only. Scutellum with long, erect, dark brown hairs and shorter, silvery, tomentose pubescence. Abdominal laterotergites with short, semidecumbent, silvery hairs and laterally also with a few short, brown, suberect hairs. Clavus and corium with short, decumbent, silvery hairs and short, erect, brown hairs intermingled.

Head pinkish brown with ocellar tubercles, ventral midline and sometimes dorsal midline posteriorly piceous; antennae and rostrum pale brown. Pronotum, scutellum, thoracic pleura, clavus and corium



Figs 55–66 *Clavigralloides* species. (55) *acantharis*, medial view of right second valvula; (56) *tuberosus tuberosus*, same; (57) *quadrituberculatus*, same; (58) *acantharis*, spermatheca; (59) *quadrituberculatus*, same; (60) *tuberosus tuberosus*, same; (61 & 62) *acantharis*, anterior and lateral views of left sclerite of wall of gynatrium; (63 & 64) *quadrituberculatus*, same; (65 & 66) *tuberosus tuberosus*, same.

pinkish brown; femora reddish brown; tibiae stramineous with basal annuli piceous, median and apical annuli or partial annuli brown, sometimes indistinct. Tarsi stramineous, more or less heavily infuscate apically. Abdominal sternites variously marked with brown, stramineous and piceous streaks and blotches, often heavily suffused pinkish brown. Laterotergites red-brown, lateral margins of IV and V each with a small, stramineous spot about one-third of the way back from anterior margin, lateral margins of VI and VII each with a large, stramineous spot in the middle.

REMARKS. This species may be recognized by the combination of the bilobed dorsal ridge of the metathoracic scent-gland peritreme and the very short external apical process of the antennifer. It is the only species of the genus in which the pubescence of the pronotum is sharply divided into pale anterior and dark posterior areas, as in many species of *Clavigralla*. Two subspecies, differing in the shape of the pronotum and the relative lengths of the antennal segments.

DISTRIBUTION. Southern China and northern India and perhaps also in adjacent mountainous areas.

Clavigralloides tuberosus tuberosus (Hsiao)

(Figs 29, 32, 43, 52, 54, 56, 60, 65, 66)

Clavigralla tuberosa Hsiao, 1964 : 252, 259, fig. 2.

Length: ♂, 9·3–11·5 mm, mean 10·4 mm (n = 39); ♀, 11·2–12·0 mm, mean 11·4 mm (n = 17).

Ratio of lengths of antennal segments I : II : III : IV about 1·00 : 0·84 : 0·71 : 0·75. Length of segment I divided by width of head including eyes 1·33–1·56, mean 1·45 (n = 13). Pronotum (Fig. 32) with posterolateral angles and spines directed laterally at right angles to longitudinal axis of body, width across tips of posterolateral spines divided by width of head including eyes 2·83–3·38, mean 3·13 (n = 13).

REMARKS. A single female from Tibet was seen. It was 10·8 mm long and retained only the first antennal segment. The length of this segment divided by the width of the head was 1·27 and the width of the pronotum divided by the width of the head was 2·59. It may represent a third subspecies and its measurements were therefore not used in drawing up the description of the typical subspecies.

DISTRIBUTION. Southern China. Type-material, which could not be examined, was collected in Fukien, Chekiang, Szechuan and Yunnan (Hsiao, 1964 : 252).

MATERIAL EXAMINED. CHINA: 1 ♀, Tibet (AMNH, New York); 1 ♂, Szechuan, Mt Omei, 16.vii.1932 (*Franck*) (BPBM, Honolulu); 1 ♂, 1 ♀, Szechuan, 2000–2300 m, 9.ix.1963 [det. Hsiao] (BMNH, London); 1 ♂, Yunnan, Yunnan-fou, viii.1932 (*Kao Pei Lan*) (BMNH, London); 1 ♂, Yunnan-fou, San-nen-Kai (*E. le Moult*) (RNH, Leiden); 1 ♂, Fukien, Yen-ping, 23.viii.1917 (AMNH, New York); 1 ♂, Fukien, Kwangtseh City, viii.1945 (*T. Maa*); 1 ♂, Fukien, Kienyang City, v.1945 (*T. C. Maa*); 1 ♂, Fukien, Chungan, Sanchiang, 11.viii.1945 (*Maa*); 1 ♂, 1 ex, without abdomen, Chungan, Upper Kuatun, 1400 m, 2.v.1945 (*Maa*); 1 ♂, Upper Kuatun. 1400 m, x.1942 (*Maa*); 5 ♂, 1 ♀, Kuatun, v.1942 (*Maa*); 27 ♂, 14 ♀, Fukien, Shaowu, Ta Chu Lan, iv–x.1942, 1943, 1945 (*Maa*) (all in BPBM, Honolulu).

Clavigralloides tuberosus indicus subsp. n.

(Fig. 34)

Length: ♂, 10·2–10·8 mm, mean 10·4 mm (n = 3); ♀, 10·2–10·6 mm, mean 10·4 mm (n = 3).

Ratio of lengths of antennal segments I : II : III : IV about 1·00 : 0·84 : 0·73 : 0·81. Length of segment I divided by width of head including eyes 1·27–1·50, mean 1·34 (n = 6). Pronotum (Fig. 34) with posterolateral angles directed slightly anteriad, not as strongly produced as in subsp. *tuberosus*, width of pronotum across tips of posterolateral spines divided by width of head across eyes 2·58–2·82, mean 2·78 (n = 6).

DISTRIBUTION. Northern India, at fairly high altitudes.

MATERIAL EXAMINED. Holotype ♂, INDIA: Chakrata (*Atkinson*) (UM, Oxford).

Paratypes. INDIA: 1 ♀, Chakrata (*Atkinson*) (UM, Oxford); 1 ♂, 1 ♀, 'E. Ind.' (*Bacon*) (UM, Oxford); 1 ♂, Assam, Delai Valley, Taphlogam, 10.xi.1936, 6000 ft (2000 m) (*M. Steele*) (BMNH, London); 1 ♀, Uttar Pradesh, Kumaon (*H. G. Champion*) (BMNH, London).

Material excluded from type-series. INDIA: 1 ex. (head and pronotum only), Himachal Pradesh, Katrain, 13.viii.1975, from field crops (*O. P. Lal*) (BMNH, London).

GRALLICLAVA gen. n.

Type-species: *Clavigralla horrens* Dohrn, 1860.

Form oblong, not depressed, connexivum moderately expanded in middle segments, aspect spinose (Fig. 71).

Head approximately two-thirds length of pronotum, granulate. Antennifers moderately divergent, process at outer apical angle of antennifer short, triangular, porrect. Antennae with segment I usually the longest, slightly expanded in apical fifth, less than one and a half times as long as width of head including eyes, granulate, more robust than II and III; segment III shortest of all, II and III minutely granulate; segment IV elongate fusiform, usually slightly shorter than I, sensory portion occupying about 90 per cent of its length. Rostrum reaching nearly to posterior margin of metasternum, segments I and II subequal, IV slightly shorter, III by far the shortest. Bucculae short, semicircular, occupying about one-quarter to one-third of ventral midline of head.

Pronotum strongly declivent, granulate, posterolateral angles elevated, laterally (rarely anterolaterally) produced, terminating in a slender, slightly upcurved spine, pronotum otherwise without spines or tubercles except for prescutellar spines on posterior margin, which is broadly and shallowly sinuate between them. Scutellum rather strongly convex, equilateral, granulate, apex slightly produced. Mesosternum and metasternum sulcate throughout. Metapleural scent-gland peritreme with dorsal ridge broadly reniform, never bilobed. Hemelytra with clavus strongly punctate, corium strongly punctate at base, becoming more weakly punctate towards apex, extreme apex smooth, slightly produced, reaching suture between laterotergites V and VI when at rest. Wings with antevannal vein visible. Anterior and intermediate femora clavate, with or without a small subapical spine beneath; posterior femora abruptly clavate, each with two large, subapical spines beneath with several very small spines between them and an apical series of four spines.

Abdominal sternites III–VII with posterolateral angles produced into spines.

Male genital capsule with lip filling posterior emargination, concealing parameres in posterior view. Phallotheca with a short, ventral sclerotization extending posterodorsally along its sides and two short, narrow, parallel dorsal sclerites. Conjunctiva with dorsomedian lobe low, its outer angles prominent; distal dorsomedian lobe membranous, long, narrow, apically bifid; distal dorsolateral lobes long or short, their posterior faces sclerotized throughout; apical ventral lobes small, rounded, membranous; distal ventrolateral lobes long, reflexed, membranous. Ejaculatory reservoir complex with paired wings, straps absent. Conjunctiva with two sclerites protecting base of vesica, the left one about twice as long as the right.

Female with tergum VIII short, IX deflexed so that opening of anus is directed ventrally. Sternum VII not cleft, but with a thickened ridge in midline, probably produced by fusion of sides of cleft. First valvifer short, first valvula quadrangular with apex obliquely truncate, paratergites VIII and IX almost vertical in the transverse plane, facing posteriorly. Second valvula obliquely truncate or bilobed at apex. Spermatheca with bulb narrowly lunate, duct attached terminally to it, not convoluted, short. Sclerites in anterior wall of gynatrium C- or L-shaped, in horizontal plane.

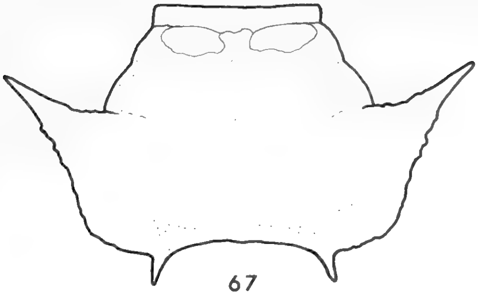
All species are very similar in colour, pubescence and sculpture of the integument. For description see under *G. indica* below. The patches of dense, white, felted hairs on the thoracic pleura and abdominal sterna are characteristic of and unique to the genus.

REMARKS. This genus is very uniform in structure and appearance and is sharply demarcated from the rest of the Pseudophloeinae by the ventrally deflexed anus of the female. Another unique characteristic of the genus is the presence of patches of densely felted hairs on the thoracic pleura and abdominal sterna. There are two well defined groups of species characterized by the form of the male genitalia.

DISTRIBUTION. Sri Lanka, India, southern China, Taiwan south-eastwards to northern Australia and the Solomon Islands.

Key to species

1	Males	2
–	Females	12



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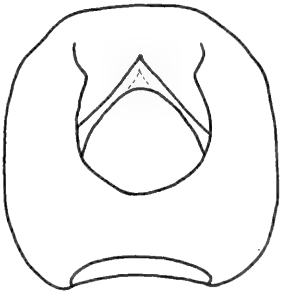

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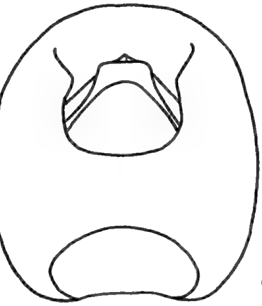

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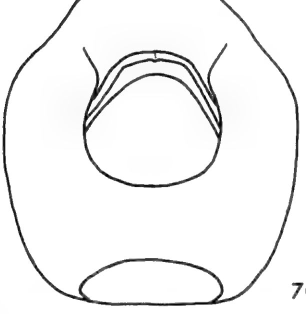

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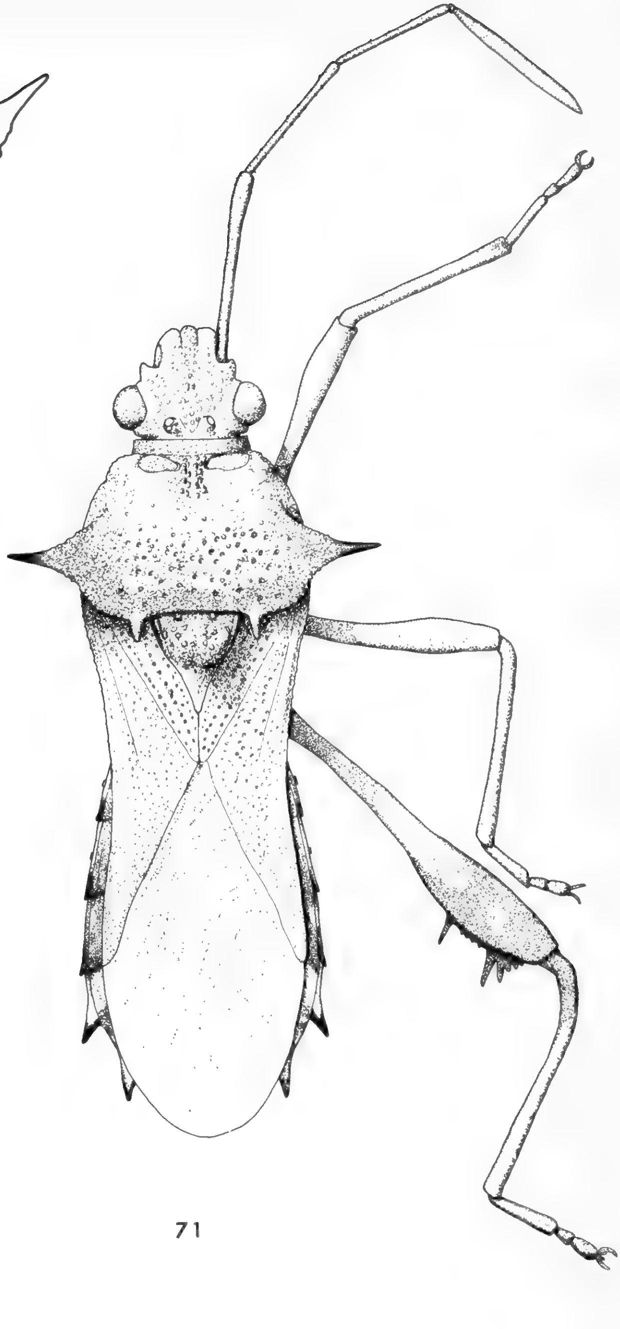

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Figs 67–71 *Gralliclava* species. (67) *horrens palawanensis*, dorsal view of pronotum; (68) *indica*, dorsal view of genital capsule with parameres and aedeagus removed; (69) *horrens horrens*, same; (70) *australiensis*, same; (71) *horrens horrens*, dorsal view.

2 Genital capsule with tongue truncate (Figs 69, 70) (*horrens*-group) 3
– Genital capsule with tongue acutely pointed (Fig. 68) (*indica*-group) 6
3 Paramere (Fig. 79) strongly angled inwards at apex. (Tropical Australia) ***G. australiensis*** sp. n. (p. 318)
– Paramere (Figs 80, 81) only weakly angled inwards at apex 4
4 Paramere (Fig. 80) with ventromedian (inner) edge weakly convex in basal two-thirds of its length. (New Guinea and adjacent island groups) . . . . ***G. irianensis*** sp. n. (p. 316)
– Paramere (Fig. 81) with ventromedian (inner) edge moderately convex in basal three-quarters of its length (***G. horrens*** (Dohrn)) 5
5 Pronotum (Fig. 71) with posterolateral angles directed laterally. (Widespread in Oriental region) . . . . ***G. horrens horrens*** (Dohrn) (p. 314)
– Pronotum (Fig. 67) with posterolateral angles directed anterolaterally. (Philippines: Palawan only) . . . . ***G. horrens palawanensis*** subsp. n. (p. 315)
6 Paramere (Figs 76–78) with tooth on inner face very prominent 7
– Paramere (Figs 72–75) with tooth on inner face less prominent 9
7 Paramere (Fig. 78) with tooth on inner face narrow. (Vietnam) . . ***G. dissimilis*** sp. n. (p. 312)
– Paramere (Figs 76, 77) with tooth on inner face broadly triangular (***G. montana*** sp. n.) . 8
8 Paramere (Fig. 76) with apical margin concave. (N. India, Sikkim) ***G. montana montana*** subsp. n. (p. 311)
– Paramere (Fig. 77) with apical margin straight or slightly convex. (S. China, Laos) ***G. montana sinensis*** subsp. n. (p. 311)
9 Length of antennal segment I divided by width of head including eyes less than 1·20 . . 10
– Length of antennal segment I divided by width of head including eyes greater than 1·20 . 11
10 Length of antennal segment II divided by length of antennal segment I about 0·79. (S. India) ***G. indica*** sp. n. (p. 307)
– Length of antennal segment II divided by length of antennal segment I about 0·86. (Java) ***G. solitaria*** sp. n. (p. 309)
11 Paramere (Fig. 73) with blade broad. (India) . . . . ***G. rubra*** sp. n. (p. 309)
– Paramere (Fig. 75) with blade narrower. (Australia: Horn I. only) . ***G. insularia*** sp. n. (p. 309)
12 Longitudinal arms of sclerites of gynatrial wall each with a broad, triangular expansion distally (Figs 86, 106–108); second valvula apically bilobed, longer lobe rounded apically. (*horrens*-group) 13
– Longitudinal arms of sclerites of gynatrial wall each distally curved or angled outwards but not expanded, of almost uniform width throughout (Figs 103–105); second valvula apically almost uniformly rounded or truncate or bilobed with the longer lobe acutely pointed apically. (*indica*-group) 16
13 Second valvula (Fig. 102) with longer lobe narrowly rounded at apex, shorter lobe not very prominent; tergum IX unicolorous. (Tropical Australia) . . . ***G. australiensis*** sp. n. (p. 318)
– Second valvula (Figs 96–101) with longer lobe more broadly rounded, shorter lobe (except in *indecora*) prominent; tergum IX with a conspicuous, brown, median macula. . . . 14
14 Second valvula (Fig. 100) with shorter lobe scarcely prominent. (Flores, Timor) ***G. indecora*** (Walker) (p. 316)
– Second valvula (Figs 96–99, 101) with both lobes well developed 15
15 Second valvula (Fig. 101) with longer lobe about as broadly rounded as shorter lobe. (New Guinea and adjacent island groups) . . . . ***G. irianensis*** sp. n. (p. 316)
– Second valvula (Figs 96–99) with longer lobe more narrowly rounded than shorter lobe. (Widespread in Oriental region). (***G. horrens*** (Dohrn)) 5
16 Second valvula (Fig. 90) with apex broadly rounded 17
– Second valvula (Figs 91–95) with apex acutely pointed or obliquely truncate 18
17 Length of antennal segment I divided by width of head including eyes less than 1·15. (India) ***G. indica*** sp. n. (p. 307)
– Length of antennal segment I divided by width of head including eyes greater than 1·15. (India) ***G. soror*** sp. n. (p. 307)
18 Second valvula (Fig. 95) with apex obscurely bilobed, longer lobe very prominent and acute. (Vietnam) . . . . ***G. dissimilis*** sp. n. (p. 312)
– Second valvula (Figs 91–94) with apex obliquely truncate (***G. montana*** sp. n.) 19
19 Second valvula (Figs 91, 92) with lobe on outer face weakly prominent. (N. India, Sikkim) ***G. montana montana*** subsp. n. (p. 311)
– Second valvula (Figs 93, 94) with lobe on outer face strongly prominent. (S. China, Laos) ***G. montana sinensis*** subsp. n. (p. 311)

Descriptions of species

The *indica*-group

Genital capsule with tongue acutely pointed (Fig. 68). Paramere with blade broad (Figs 72–78). Conjunctiva with distal dorsolateral lobes short (Fig. 82). Sclerites of wall of gynatrium with apex of longitudinal arm curved or angled outwards at apex but not triangularly expanded (Figs 103–105).

Gralliclava indica sp. n.

(Figs 68, 72, 90, 103)

Length: ♂, 7·0–7·7 mm, mean 7·2 mm (n = 15); ♀, 7·5–7·7 mm (n = 4).

Characters of the genus and of the species-group. Antennae rather short, ratio of lengths of antennal segments I : II : III : IV about 1·00 : 0·79 : 0·63 : 0·89; length of segment III divided by that of segment II 0·76–0·85, mean 0·80 (n = 15); length of segment I divided by width of head including eyes 1·03–1·12, mean 1·07 (n = 17). Ratio of lengths of rostral segments I : II : III : IV about 1·00 : 1·02 : 0·47 : 0·90. Pronotum with posterolateral spines slightly upcurved, rather short, width of pronotum across tips of spines divided by width of head including eyes 2·25–2·55, mean 2·40 (n = 17).

Male genital capsule (Fig. 68) with tongue acute. Paramere (Fig. 72) with apical margin rounded, tooth on inner margin broad and moderately prominent. Female with apex of second valvula (Fig. 90) rounded, sclerites of gynatrial wall with inner arms of almost uniform width in dorsal aspect, apices obliquely divergent (Fig. 103).

Head and pronotum moderately strongly granulate, rest of body and appendages very weakly granulate.

Head, exposed parts of thorax and abdomen, antennae, legs, clavus and corium with short, fine, suberect pubescence; head, abdominal sternites and exposed parts of thorax also with decumbent, white, woolly pubescence, femora with similar but very sparse woolly pubescence. Thoracic pleura and lateral areas of abdominal sternites with patches of very dense, felted, white pubescence.

Head, pronotum, scutellum, thoracic pleura and sterna dark red. Antennae with segments I–III stramineous, IV reddish brown. Hemelytra stramineous with apex of corium dark red. Rostrum, tarsi, anterior and intermediate tibiae and metathoracic scent-gland auricle stramineous. Anterior and intermediate femora stramineous with apical half obscurely reddish, posterior femur with basal half stramineous, apical half dark red with three irregular stramineous patches on anterior face and three on posterior face. Posterior tibiae stramineous with dark red basal annulus and obscure reddish markings at middle and apex of dorsal side. Abdominal sternites pale reddish brown with blackish brown markings medially on sternites V and VI and mediolaterally on III and IV and with a large stramineous spot on lateral margins of VI and VII. Laterotergites each stramineous anteriorly, red posteriorly. Tergites dark red, VI and VII stramineous anterolaterally, red-brown posteriorly.

Remarks. All of the specimens mentioned by Distant (1918 : 159) belong to this species. It may be distinguished from the other peninsular-Indian species of its species-group by the greater length of antennal segment III relative to that of segment II and from the other members of the species-group with segment III long by the short sclerites of the gynatrial wall, the apically rounded second valvula and the less strongly developed tooth on the inner side of the male paramere.

Distribution. Southern India.

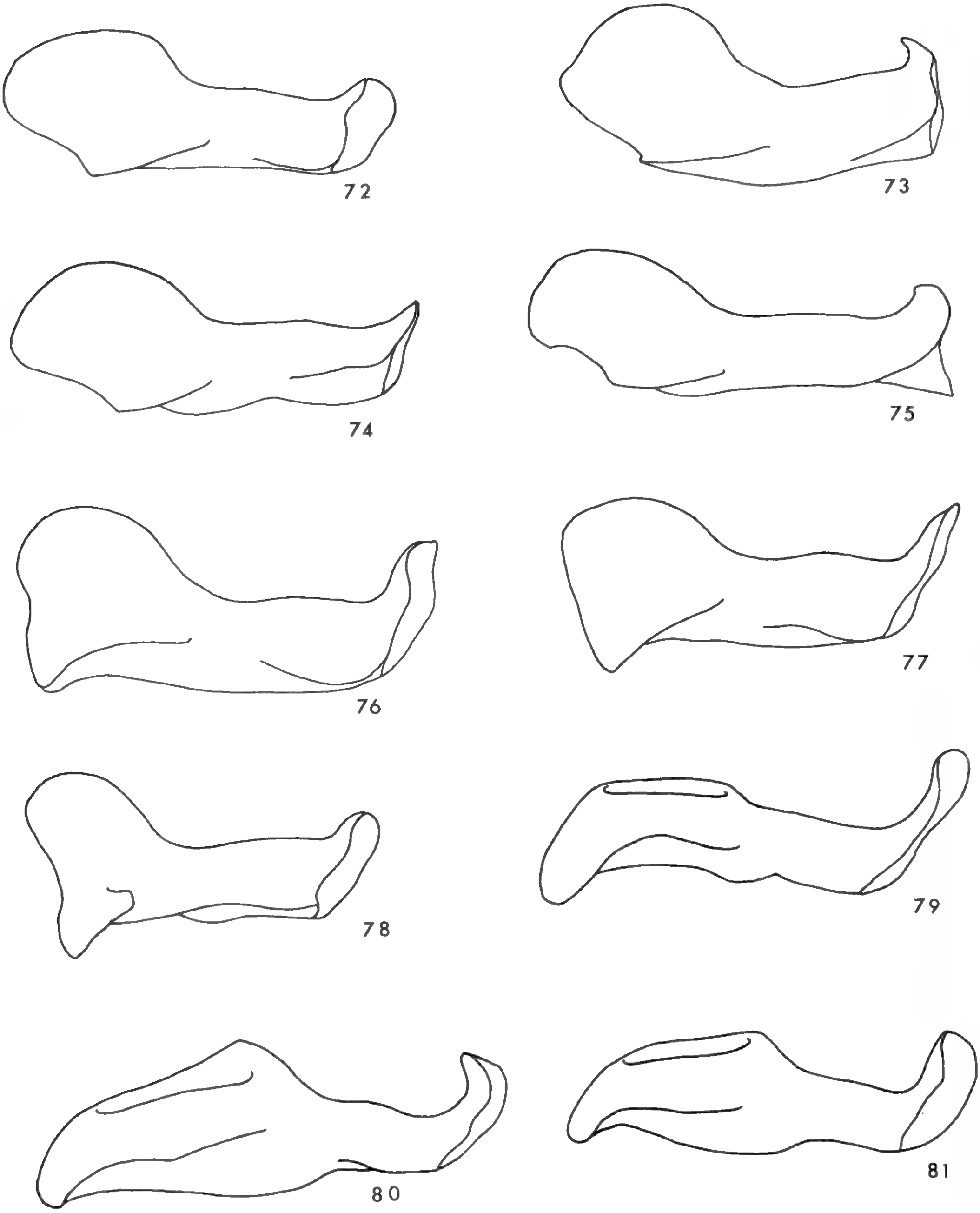
Material examined. Holotype ♂, India: Chikkaballapura (*T. V. Campbell*) (BMNH, London).

Paratypes. India: 7 ♂, 2 ♀, same data as holotype; 2 ♂, Kodai Kanal (*Campbell*); 4 ♂, 'South India' (Campbell); 1 ♂, Kotagiri (*Atkinson*) (all in BMNH, London); 3 ♂, 2 ♀, Utakamand (*Atkinson*) (UM, Oxford); 1 ♀, Utakamand (*Atkinson*) (BMNH, London).

Gralliclava soror sp. n.

Length: ♀, 7·8–8·0 mm, mean 7·9 mm (n = 4); ♂ unknown.

Closely resembles *G. indica*. Ratio of antennal segments I : II : III : IV about 1·00 : 0·82 : 0·68 : 0·82; length of segment III divided by that of segment II 0·75–0·79, mean 0·76 (n = 4); length of segment I divided by head width including eyes 1·20–1·27, mean 1·22 (n = 4). Pronotum with posterolateral spines straight, not upturned, width of pronotum across tips of spines divided by width of head including eyes 2·45–2·50, mean 2·48 (n = 4). Woolly pubescence less dense than in *G. indica*. Female genitalia as in *G. indica*.



Figs 72–81 *Gralliclava* species, dorsomedial view of left paramere. (72) *indica*; (73) *rubra* (holotype); (74) *solitaria* (holotype); (75) *insularia* (holotype); (76) *montana montana* (holotype); (77) *montana sinensis* (holotype); (78) *dissimilis*; (79) *australiensis*; (80) *irianensis*; (81) *horrens horrens*.

REMARKS. Differs from *G. indica* in the proportions of the lengths of the antennal segments and in the straight posterolateral pronotal spines. Male unknown.

DISTRIBUTION. Known only from one locality in India.

MATERIAL EXAMINED. Holotype ♀, INDIA: Bombay (*Distant* collection) (BMNH, London).
Paratypes. INDIA: 2 ♀, Bombay (*Distant* collection); 1 ♀, Bombay (*R. R. Holmes* purchase) (all in BMNH, London).

Gralliclava rubra sp. n.

(Fig. 73)

Length: ♂, 7·6 mm (n = 1); ♀ unknown.
Closely resembles *G. indica*. Ratio of lengths of antennal segments unknown (specimen damaged), length of segment I divided by width of head including eyes 1·34. Pronotal posterolateral spines longer and more slender than those of *G. indica*, width across tips of spines divided by width of head including eyes 2·76. Colour paler, brighter red than in *G. indica*. Male paramere slightly broader than in that species (Fig. 73).

REMARKS. Appears to be very closely related to *G. indica*, and can only be distinguished with certainty by the slight difference in the shape of the paramere. Although the ratio pronotum width/head width is within the range given for *indica* the disc of the pronotum is narrower than in that species, so that the posterolateral spines appear distinctly longer when the two species are seen together. Female unknown.

DISTRIBUTION. Known only from one locality in India.

MATERIAL EXAMINED. Holotype ♂, INDIA: Khandala, 15.x.1944 (*D. Leston*) (BMNH, London).

Gralliclava solitaria sp. n.

(Fig. 74)

Length: ♂, 7·0 mm (n = 1); ♀, 7·8 mm (n = 1).
Very similar to *G. indica*. Ratio of lengths of antennal segments I : II : III : IV in male 1·00 : 0·86 : 0·67 : 1·00, in female 1·00 : 0·87 : 0·68 : 0·89; length of segment III divided by that of segment II 0·78 in both sexes; length of segment I divided by width of head including eyes 1·12 in both sexes. Width of pronotum across tips of posterolateral spines divided by width of head including eyes in male 2·45, in female 2·80. Male paramere (Fig. 74) with tooth less prominent than that of *G. indica*. Colour darker red than in *G. indica*, posterior femur with apical half dark red with a single, irregular stramineous spot anteriorly and posteriorly.

REMARKS. Differs from *G. indica* in the relative lengths of the antennal segments, also in the shape of the paramere. In the only female specimen available the genitalia were too badly damaged to examine.

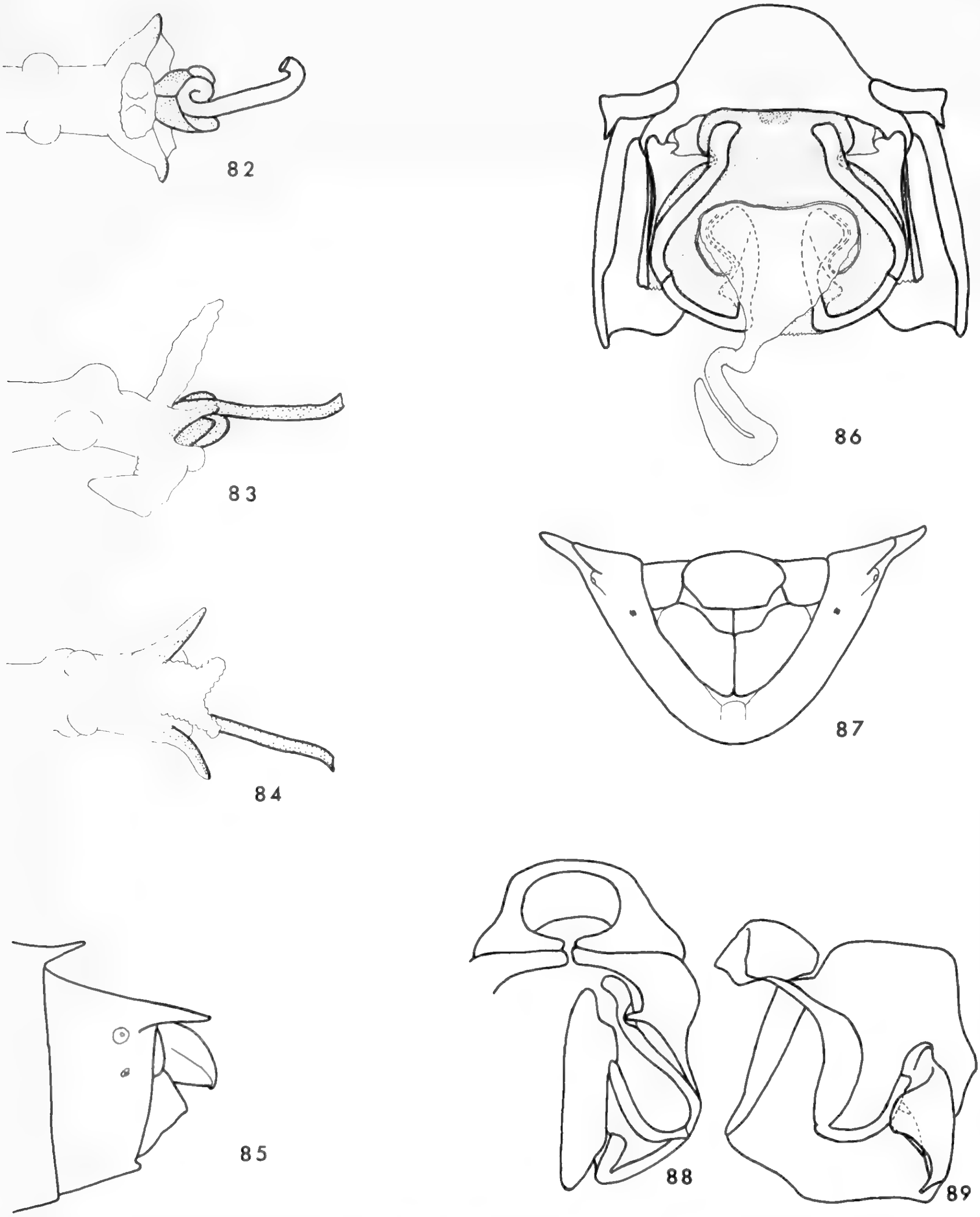
DISTRIBUTION. Known from a single locality in Java.

MATERIAL EXAMINED. Holotype ♂, JAVA: G. Tangkoeban Pranhoe, Preanger, 4000–5000 voet (1200–1500m), xi.1936 (*F. C. Drescher*) (RNH, Leiden).
Paratype. JAVA: 1 ♀, same data as holotype except for date, i.1937 (RNH, Leiden).

Gralliclava insularia sp. n.

(Fig. 75)

Length: ♂, 7·2 mm (n = 1); ♀ unknown.
Very similar to *G. indica*. Ratio of lengths of antennal segments I : II : III as 1·00 : 0·81 : 0·60 (IV missing in specimen examined); length of segment III divided by length of segment II 0·74; length of segment I divided by width of head including eyes 1·31 (n = 1 in each case). Width of pronotum across tips of posterolateral spines divided by width of head including eyes about 2·50 (single specimen examined with spines damaged). Paramere (Fig. 75) with blade narrower than in the other species related to *G. indica*.



Figs 82–89 *Gralliclava* species. (82) *montana montana*, dorsal view of conjunctiva and vesica; (83 & 84) *horrens horrens*, left lateral and dorsal views of same; (85) *horrens horrens*, left lateral view of ♀ abdomen from posterior margin of segment VI to apex; (86) *horrens horrens*, dorsal view of structures of ♀ abdominal segments VIII and IX (tergum VIII removed); (87) *horrens horrens*, apical view of ♀ abdominal segments VII–IX; (88) *horrens horrens*, ventral view of ♀ abdominal segment IX (paired structures of left side omitted); (89) *horrens horrens*, medial view of paired structures of right side of ♀ abdominal segment VIII, i.e. paratergite, gonangulum (part of IX), valvifer, valvula and ramus. Stipple in Figs 82–84 indicates sclerotized parts; in Fig. 86 stipple indicates membrane, sparse stipple indicating gynatrial sac.

Remarks. Although this species has been collected only in a locality remote from the range of the other species of the *indica*-group the unique paramere shape suggests that its presence there is not due to a chance introduction by commerce.

Distribution. Known only from the type-locality, a small island off Cape York, Queensland.

Material examined. Holotype ♂, Australia: Torres Straits, Horn Island (no other data) (SAM, Adelaide).

Gralliclava montana sp. n.

(Figs 76, 77, 82, 91–94, 104)

Length: 7·8–9·4 mm.

Similar to *G. indica* but larger and darker red. Pronotum with posterolateral spines long, distinctly upcurved. Male with paramere (Figs 76, 77) bearing on inner face a broad, triangular tooth close to apex. Female with second valvula (Figs 91–94) obliquely truncate at apex, sclerites of wall of gynatrium (Fig. 104) long.

Remarks. This species is readily distinguished from others related to *G. indica* by the shape of the paramere and second valvula.

Distribution. Two subspecies, one in the southern Himalayas and one in southern China and Indochina.

Gralliclava montana montana subsp. n.

(Figs 76, 82, 91, 92, 104)

Length: ♂, 8·0–8·5 mm, mean 8·3 mm (n = 3); ♀, 7·8–8·8 mm, mean 8·3 mm (n = 6).

Ratio of lengths of antennal segments I : II : III : IV about 1·00 : 0·71 : 0·62 : 0·88: length of segment III divided by length of segment II 0·85–0·91, mean 0·87 (n = 8); length of segment I divided by width of head including eyes in male 1·32–1·45, mean 1·37 (n = 3), in female 1·10–1·24, mean 1·14 (n = 6). Width of pronotum across tips of posterolateral spines divided by width of head including eyes 2·50–2·85, mean 2·64 (n = 9). Male paramere with distal margin of tooth not forming a continuous line with apical margin of blade (Fig. 76). Second valvula of ovipositor (Figs 91, 92) with a small protuberance on outer face. Apical half of posterior femur dark red with usually a single, discrete stramineous spot on anterior and on posterior face.

Remarks. Distinguished from the following subspecies by the shape of the paramere and the shape of the second valvula. One female from Kumaon has more extensive pale markings in the apical half of the posterior femur, resembling the typical colour pattern of *G. indica*.

Distribution. Southern slopes and foothills of the Himalayas.

Material examined. Holotype ♂, India: W. Almora, Kumaon (*H. G. Champion*) (BMNH, London).

Paratypes. India: 1 ♂, 2 ♀, same data as holotype; 3 ♀, Darjeeling, Gopaldhara, 4720 feet (1430 m), 2–21.v.1918, one ex. from flowers (*H. Stevens*). Nepal: 1 ♀, Ghanpokhara, 5500–7000 ft (1700–2100 m), 2.v.1954 (*J. Quinlan*). Sikkim: 1 ♂ (*Distant* collection). (All in BMNH, London.)

Gralliclava montana sinensis subsp. n.

(Figs 77, 93, 94)

Length: ♂, 8·6–8·8 mm, mean 8·7 mm (n = 3); ♀, 8·3–9·7 mm (n = 2).

Ratio of lengths of antennal segments I : II : III : IV about 1·00 : 0·73 : 0·63 : 0·91; length of segment III divided by length of segment II 0·85–0·89, mean 0·87 (n = 4); length of segment I divided by width of head including eyes in male 1·17–1·34, mean 1·27 (n = 3), in female 1·12–1·25 (n = 2). Width of pronotum across tips of posterolateral spines divided by width of head including eyes 2·74–3·19, mean 2·92 (n = 5). Male paramere (Fig. 77) with distal margin of tooth forming a continuous straight or slightly convex line with apical margin of blade. Second valvula of ovipositor (Figs 93, 94) with a large protuberance on the outer face, projecting dorsolaterally beyond the dorsal margin of the valvula when the

latter is examined flat. Apical half of posterior femur with a single, obscure, pale spot on anterior and on posterior face.

REMARKS. Distinguished from the nominate subspecies by the shape of the paramere and of the second valvula. The differences are slight and, in the case of the paramere, variable but are nonetheless constant.

DISTRIBUTION. Southern China and Indochina.

MATERIAL EXAMINED. Holotype ♂, CHINA: Kwangtung, Sheung-shui-heung, Lin-hsien (District), 9–10.xi.1934 (*F. K. To*) (BMNH, London).

Paratypes. CHINA: 1 ♂, Fukien, Chung An, Bohea Hills, 22.x.1939 (*T. C. Maa*); 2 ♀, Fukien, Shaowu, Ta Chu Lan, 25.vi.1942 and 9.vi.1943 (*Maa*) (all in BPBM, Honolulu). LAOS: 1 ♂, Xieng Khouang, 11.v.1919 (*R. V. de Salvaza*) (BMNH, London).

Gralliclava dissimilis sp. n.

(Figs 78, 95, 105)

Length: ♂, 7·1 mm (n = 3); ♀, 7·7 mm (n = 3).

Similar to *G. indica*. Ratio of lengths of antennal segments I : II : III : IV about 1·00 : 0·77 : 0·67 : 0·98; length of segment III divided by length of segment II 0·82–0·91, mean 0·87 (n = 4); length of segment I divided by width of head including eyes 1·26–1·39, mean 1·30 (n = 6). Pronotum with posterolateral spines gently upcurved, width across tips of spines divided by width of head including eyes 2·48–2·61, mean 2·54 (n = 6). Male paramere (Fig. 78) of characteristic shape, with very prominent tooth on inner face. Second valvula of ovipositor (Fig. 95) with a large dorsolateral protuberance and with apex acutely pointed, prominent. Sclerites of wall of gynatrium long (Fig. 105). Colour darker red than in *G. indica*, pale markings at apex of posterior femur smaller and fewer than in that species.

REMARKS. The peculiar shape of the paramere distinguishes this species from all others in the genus. The presence of a dorsolateral protuberance on the second valvula suggests affinities to *G. montana*.

DISTRIBUTION. Known only from the type-locality in Vietnam.

MATERIAL EXAMINED. Holotype ♂, VIETNAM: 6 miles (9·5 km) S. of Dalat, 1400–1500 m, 9.vi–7.vii.1961 (*N. R. Spencer*) (BPBM, Honolulu).

Paratypes. VIETNAM: 2 ♂, 3 ♀, same data as holotype (BPBM, Honolulu and BMNH, London).

The *horrens*-group

Genital capsule with tongue truncate (Figs 69, 70). Paramere with blade narrow apically (Figs 79–81). Conjunctiva with distal dorsolateral lobes long (Fig. 84). Sclerites of wall of gynatrium with apex of longitudinal arm triangularly expanded (Figs 86, 106–108).

Gralliclava horrens (Dohrn) comb. n.

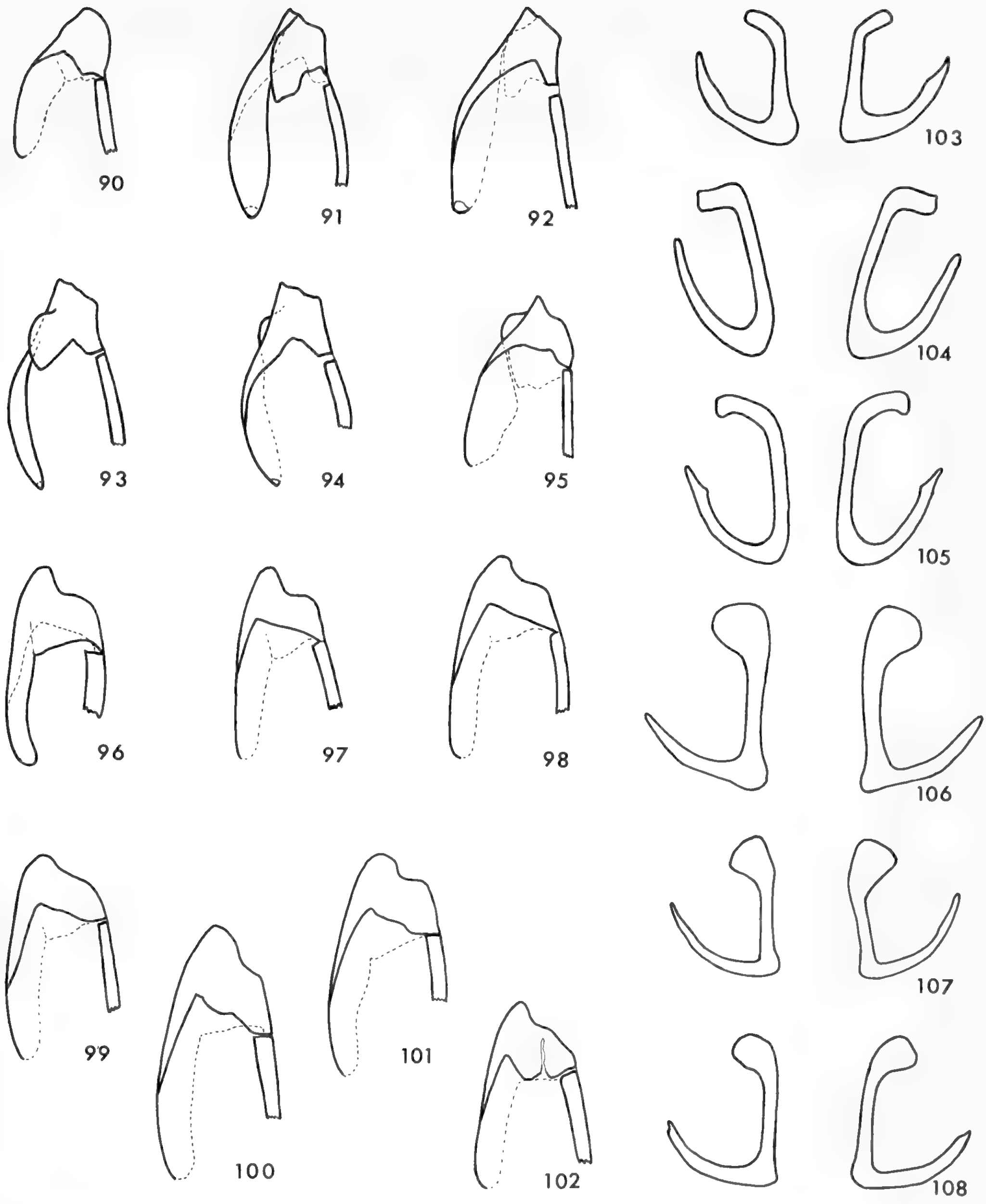
(Figs 67, 69, 71, 81, 83–89, 96–99)

Clavigralla horrens Dohrn, 1860 : 403. LECTOTYPE ♀, SRI LANKA (IZPAN, Warsaw), here designated [examined].

Clavigralla spinofemoralis Shiraki, 1913 : 225. Type-series from TAIWAN (Taihoku) [not traced]. **Syn. n.**

Length: ♂, 6·5–8·5 mm, mean 7·6 mm (n = 86); ♀, 7·2–8·9 mm, mean 8·0 mm (n = 85).

Characters of the genus and of the species-group. Ratio of lengths of antennal segments I : II : III : IV about 1·00 : 0·79 : 0·67 : 0·93; length of segment III divided by length of segment II 0·82–0·86 (population means). Ratio of lengths of rostral segments I : II : III : IV about 1·00 : 0·96 : 0·48 : 0·87. Male paramere (Fig. 81) with blade narrowly triangular, its apex markedly produced and its ventromedian edge moderately convex for basal three-quarters of its length. Genital capsule with tongue rectangularly produced, apically truncate, not notched in middle of posterior margin (Fig. 69). Second valvula of ovipositor (Figs 96–99) with apex bilobed, the inner (upper) lobe narrower and more prominent than the lower and bluntly angulate at apex. Sclerites of gynatrial wall with median arms in dorsal view triangularly broadened and divergent posteriorly (Fig. 86).



Figs 90–108 *Gralliclava* species. (90) *indica*, medial view of right second valvula; (91 & 92) *montana montana*, median and lateral views of same; (93 & 94) *montana sinensis*, same; (95) *dissimilis*, medial view of same; (96 & 97) *horrens horrens* (Ceylon), lateral and medial views of same; (98) *horrens horrens* (Uttar Pradesh), medial view of same; (99) *horrens horrens* (Java), same; (100) *indecora* (holotype), same; (101) *irianensis*, same; (102) *australiensis*, same; (103) *indica*, dorsal view of sclerites of wall of gynatrium; (104) *montana montana*, same; (105) *dissimilis*, same; (106) *indecora* (holotype), same; (107) *irianensis*, same; (108) *australiensis*, same.

Sculpture, pilosity and colour generally as in *G. indica*. Female abdominal tergite IX always with a piceous median macula. Posterior femur with one or two stramineous spots on anterior and posterior faces in dark red apical half.

REMARKS. A widespread and common species which may be distinguished from its congeners by the shape of the paramere and of the second valvula.

DISTRIBUTION. Oriental region, from Sri Lanka, India, southern China and Taiwan southwards and eastwards to the lesser Sunda Islands. Two subspecies, one restricted to Palawan (Philippines).

Gralliclava horrens horrens (Dohrn)

(Figs 69, 71, 81, 83–89, 96–99)

Clavigralla horrens Dohrn, 1860 : 403.

Length: ♂, 6·5–8·5 mm, mean 7·6 mm (n = 81); ♀, 7·2–8·9 mm, mean 8·0 mm (n = 76).

Length of antennal segment III divided by length of segment II 0·76–0·91 (n = 254), population means vary from 0·81 to 0·86. Length of antennal segment I divided by width of head including eyes 1·06–1·38 (n = 254), population means vary from 1·16 to 1·35. Pronotum with posterolateral angles directed laterally (Fig. 71), posterolateral spines gently upcurved, width across tips of spines divided by width of head including eyes 2·39–3·15 (n = 254), population means vary from 2·56 to 2·91. Form of male and female genitalia (Figs 69, 81, 83–89, 96–99) very constant throughout the range of the subspecies, inner (upper) lobe of second valvula sometimes slightly shorter than normal (Fig. 99).

REMARKS. Differs from the following subspecies chiefly in the shape of the pronotum. Local variation is considerable in this widespread species, but this variation is not clinal. There was insufficient material from some islands to determine if some of these forms deserved subspecific or higher ranking. A long series from Java closely resembled the population on the Asian mainland. The three available specimens from different localities in Sumatra all had the apical half of the posterior femur uniformly red, devoid of paler markings. The second valvula of specimens from Taiwan and some localities in northern India displayed a slightly shorter inner (upper) lobe (Fig. 99) than that found in the other parts of the geographical range. Specimens from the eastern parts of the range had parameres in which the apex was slightly less prominent and the

Table 1. Variation in lengths of antennal segments and width of pronotum in *Gralliclava horrens horrens* (Dohrn)

	Length of antennal segment III divided by length of segment II			Length of antennal segment I divided by width of head			Width of pronotum divided by width of head			
Locality	Minimum	Maximum	Mean	Minimum	Maximum	Mean	Minimum	Maximum	Mean	Number of specimens measured
Sri Lanka	0·81	0·91	0·86	1·20	1·32	1·26	2·48	2·78	2·67	9
India*	0·81	0·87	0·85	1·15	1·34	1·23	2·46	2·82	2·59	18
China†	0·79	0·87	0·83	1·12	1·30	1·19	2·68	3·15	2·85	34
Thailand	0·79	0·86	0·83	1·15	1·35	1·25	2·41	2·82	2·59	21
Indochina	0·80	0·85	0·83	1·12	1·30	1·21	2·39	2·72	2·56	13
West Malaysia	0·82	0·89	0·85	1·12	1·38	1·26	2·48	2·88	2·70	12
Taiwan	0·80	0·84	0·82	1·13	1·32	1·24	2·53	2·75	2·68	6
Luzon	0·81	0·87	0·83	1·06	1·28	1·16	2·50	2·78	2·65	16
Mindanao	0·82	0·89	0·84	1·14	1·30	1·21	2·45	2·97	2·66	108
Java	0·77	0·88	0·82	1·11	1·36	1·24	2·40	2·74	2·61	15
Sumatra	0·76	0·86	0·81	1·14	1·38	1·26	2·77	2·91	2·84	3
Borneo	0·82	0·86	0·83	1·32	1·37	1·35	2·82	3·04	2·91	4
Sulawesi	0·81	0·83	0·82	1·19	1·33	1·26	2·51	2·78	2·63	5

* Including Nepal and Sikkim.
† Including Hong Kong.

ventrolateral edge slightly less convex, approaching the shape of the paramere of *G. irianensis*, though clearly distinct from it. Specimens from mainland China had, on average, a shorter antennal segment I and longer pronotal spines than those of most other populations and were in these respects the most distinct of the mainland populations. Variation in the lengths of the antennal segments and pronotal spines is summarized in Table 1.

DISTRIBUTION. Sri Lanka, India, S. China eastwards to Taiwan, Philippines (except Palawan) and Sunda Islands.

MATERIAL EXAMINED. *Clavigralla horrens* Dohrn, lectotype ♀, SRI LANKA (*Nietner*) (IZPAN, Warsaw).

Numerous specimens from the following localities. SRI LANKA: Colombo; Kandy; Pundaloya; Madulsima; Nitagula. INDIA: Uttar Pradesh, Ranikhet; Uttar Pradesh, Lansdowne Division; Western Almora, Kumaon; Malabar, Amarambalam Forest; Assam; Devala, Nilgiri Hills. SIKKIM (no further data). NEPAL: Taplejung District. HONG KONG. CHINA: Hainan I., Nodoa; Fukien, Chung An, Bohea Hills; Fukien, Yungan City; Fukien, Shaowu, Shui Pei Kai; Fukien, Haiteng, Hungkeng; Fukien, Lo Fou Mountains; Yunnan, San-nen-Kai. BURMA: Carin, Askiuii Ghecu; Rangoon. THAILAND: Chiangmai, Pangmakampon, near Fang; Doi Suthep; Fang; 50 km W. of Tak; Parjinburi Province, Amphur Kabinburi; Bankau. LAOS: Île de Khong; Dong Dok; Borikhame Province, Pakkading. VIETNAM: north-west of Phan Rang; Karyu Danar; Ninh Hoa and Dai Lanh, N. of Nha Trang; M'Drak, E. of Ban Me Thuot. WEST MALAYSIA: Pahang; Perak; Kuala Lumpur; Langkawi Is. TAIWAN: Bukai-Musha; Puli; Kuraru, Hengchun Park. PHILIPPINES: Luzon, Trinidad; Luzon, Baguio; Luzon, Los Baños, Luzon, Balbalasan; Luzon, Lubuagan; Luzon, Mt Carabalho; Luzon, Manila; Luzon, Benquet; Luzon, Isabela San Mariano; Luzon, Bataan; Luzon, Rizal, Montalban; Luzon, Mt Iriga; Luzon, Mt Isarog; Luzon, Ft McKinley; Luzon, Mayoyao, Ifugao; Busuanga, 4 km N. of San Nicolaso; Samar, Catbalogan; Panay, Capiz, Jamindanao; Negros, Dumaguete; Bohol; Leyte, Utap; Leyte, Palo; Mindanao, Momungan; Mindanao, Sapamoro; Mindanao, Bukidon, Malaybalay, Alanib; Mindanao, Lanao; Mindanao, Dansalan; Mindanao, Zamboanga; Mindanao, Balason; Mindanao, Mt Malindang; Mindanao, Davao; Mindanao, Zamboanga; Mindanao, Lemesahan. BORNEO: Sabah, Keningan; Sabah, Ranau; Sarawak, Sarikei District, Rejang Delta; Sarawak, Bau District, Pangkalan Tebang. SUMATRA: Sungei Kumbang, Corinchi; Deli; Serdang, Tandjong Morawa. JAVA: Semarang; Cheribon; Bogor. POSTILJON ISLANDS: Sapoeka Besar. SULAWESI: Makassar; Gorontalo; Salayer I.; Sula Is. TIMOR: Ermera; Dili. WETTER (no locality stated). (BMNH, London; AMNH, New York; BPBM, Honolulu; RNH, Leiden; UZM, Copenhagen; SAM, Adelaide.)

Gralliclava horrens palawanensis subsp. n.

(Fig. 67)

Length: ♂, 7·1–7·5 mm, mean 7·3 mm (n = 5); ♀, 7·7–8·3 mm, mean 8·0 mm (n = 9).

Length of antennal segment I divided by width of head including eyes 1·23–1·43, mean 1·30 (n = 14). Posterolateral angles and spines of pronotum (Fig. 67) directed obliquely forwards, width across tips of spines divided by width of head including eyes 2·35–2·69, mean 2·53 (n = 14). Otherwise similar to typical subspecies in appearance, genitalia, sculpture, pubescence and colour.

REMARKS. Readily distinguished from the nominate subspecies and all other species of the genus by the shape of the pronotum. Several collections have been made at various times and in a number of different localities in Palawan, but no specimen with the pronotal posterolateral spines and angles directed laterally has been found there. Because of the similarity of the Palawan population to other *horrens* populations in genitalia and other characters and because of the allopatry of populations exhibiting the two forms of pronotum subspecific status seems appropriate.

DISTRIBUTION. Known only from Palawan Island in the Philippines.

MATERIAL EXAMINED. Holotype ♂, PHILIPPINES: Palawan, Punta Baha, 26.v.1958 (*H. E. Milliron*) (BPBM, Honolulu).

Paratypes. PHILIPPINES: 1 ♂, 1 ♀, Palawan, Bacuit (*G. Böttcher*) (BMNH, London); 1 ♀, Palawan, Binaluan, xi–xii.1913 (*G. Boettcher*) (BMNH, London); 2 ♂, 1 ♀, Palawan, Brooke's Point, Macagua, 75 m, 1–4.iv.1962 (*M. Thompson*) (BPBM, Honolulu and BMNH, London); 2 ♂, Palawan, Brooke's Point, Uring Uring, 18.viii.1961 and 20.ix.1961 in Malaise trap (*Noona Dan Expedition*) (UZM, Copenhagen); 1 ♀, Palawan, Tarumpitao Point, in jungle, 3.vi.1958 (*H. E. Milliron*) (BPBM, Honolulu); 6 ♀, Palawan, Eran Point, 8 km SW. of Tarumpitao Point, 31.xii.1959–4.i.1960 (*L. W. Quate*) (BPBM, Honolulu and BMNH, London); 1 ♂, 1 ♀, Palawan, Mantalingajan, Pinigisan, 600 m, 1.ix.1961 (*Noona Dan Expedition*) (UZM, Copenhagen).

Gralliclava indecora (Walker) **sp. rev., comb. n.**

(Figs 100, 106)

Cletus ? indecorus Walker, 1871 : 197. Holotype ♀, FLORES (Indonesia) (BMNH, London) [examined].
Clavigralla indecora (Walker) Distant, 1901 : 426.
[*Clavigralla horrens* Dohrn; Bergróth, 1913 : 156. *Cletus ? indecorus* Walker incorrectly synonymized with *Clavigralla horrens* Dohrn.]

Length: ♀, 8·7–8·8 mm (n = 2); ♂ unknown.

Very similar to *G. horrens*. Ratio of lengths of antennal segments I : II : III : IV as 1·00 : 0·75 : 0·66 : 0·89 (type) or 1·00 : 0·83 : 0·67 : 0·98; length of segment III divided by length of segment II 0·88 (type) or 0·80; length of segment I divided by width of head including eyes 1·25 (type) or 1·20. Width of pronotum across posterolateral spines divided by width of head including eyes 2·53 (type) or 2·77. Ovipositor with second valvula having inner (upper) lobe long, outer (lower) lobe obsolete (Fig. 100). Sclerites of gynatrial wall (Fig. 106) similar to those of *G. horrens*. Male unknown. Anterior and intermediate femora with apical half dark red with a few stramineous spots.

REMARKS. Differs from other species of the subgenus in the shape of the second valvula. Differs from *G. horrens* in the coloration of the anterior and intermediate femora (in *horrens* the apical halves of these femora are paler red with more extensive pale markings). Sympatric with *horrens* at least in Timor. Walker (1871 : 197) erroneously indicated the sex of the type-specimen as male.

DISTRIBUTION. Flores and Timor in Indonesia.

MATERIAL EXAMINED. *Cletus ? indecorus* Walker, holotype ♀, FLORES (Indonesia) (*Saunders* collection) (BMNH, London).

TIMOR: 1 ♀, Wienek (RNH, Leiden).

***Gralliclava irianensis* sp. n.**

(Figs 80, 101, 107)

Length: ♂, 7·1–8·8 mm, mean 7·5 mm (n = 36); ♀, 7·7–9·3 mm, mean 8·3 mm (n = 30).

Very similar to *G. horrens*. Ratio of lengths of antennal segments I : II : III : IV about 1·00 : 0·83 : 0·68 : 0·86; length of segment III divided by length of segment II 0·76–0·87, mean 0·81 (n = 56); length of segment I divided by width of head including eyes 1·23–1·46, mean 1·33 (n = 61). Pronotal posterolateral spines rather long, upcurved, width across tips of spines divided by width of head including eyes 2·51–3·08, mean 2·71 (n = 61). Male with paramere (Fig. 80) with apex slightly produced, and its ventromedian edge weakly convex for basal two-thirds of its length. Tongue of genital capsule as in *G. horrens*. Second valvula of ovipositor (Fig. 101) bilobed, both lobes broadly rounded, the inner (upper) lobe more prominent. Sclerites of gynatrial wall (Fig. 107) similar to those of *horrens*. Posterior femur with apical half dark red, usually devoid of paler markings.

REMARKS. Differs from other species of the genus in the shape of the paramere and of the second valvula.

DISTRIBUTION. New Guinea and adjacent island groups.

MATERIAL EXAMINED. Holotype ♂, NEW GUINEA: Papua, Mondo, 5000 ft (1500 m), ii.1934 (*L. E. Cheesman*) (BMNH, London).

Paratypes. AMBOINA: 3 ♂ (*F. Muir*) (BPBM, Honolulu). MYSOL: 1 ♂ (*Saunders* collection) (BMNH, London). NEW GUINEA: 2 ♂, 1 ♀, Irian Barat, 'Komba' (? = Kumbe) (*L. Wagner*)

(SAM, Adelaide); 1 ♀, I. B., Paniai, 9.ix.1939 (*Nieuw Guinea Exp. K.N.A.G. 1939*) (RNH, Leiden); 9 ♂, 4 ♀, I. B., Star Range, 1500 m, bivak 39a, 28.vi.1959 (*Neth. New Guinea Expedition*); 2 ♂, 1 ♀, I. B., Star Range, 1260 m, Sibil, 16–18.vi.1959 (*Neth. New Guinea Expedition*); 1 ♂, I. B., Star Range, 1500 m, Ok Tenma, 19.v.1959 (*Neth. New Guinea Expedition*); 2 ♂, 1 ♀, I. B., Ifar, 300 m, 10.ix.1959 (*C. v. Heijuingen, Neth. New Guinea Expedition*); 3 ♂, 2 ♀, I. B., Nabire, S. Geelvink Bay, 14.ix.1962, light-trap (*H. Holtman*); 1 ♂, I. B., Nabire, S. Geelvink Bay, 17.ix. 1962, in jungle (*Holtman*); 1 ♂, I. B., Nabire, S. Geelvink Bay, 1–20 m, 5.vii.1962 (*J. L. Gressitt*); 1 ♀, I. B., Nabire, 5–50 m, 25.viii.–2.ix.1962 (*J. Sedlacek*); 3 ♂, I. B., Vogelkop, Jef Lio I., Sele Straits, 1–5 m, 15.viii.1957 (*D. Elmo Hardy*); 1 ♂, I. B., Vogelkop, Fak Fak, S. Coast of Bomberai, 10–100 m, 10.vi.1959 (*T. C. Maa*); 1 ♂, 1 ♀, I. B., Wisselmeren, Kamo-Debei div., 1700 m, 13.viii.1955 (*Gressitt*); 2 ♂, 1 ♀, I. B., Wisselmeren, 1500 m, Itouda, Kamo Valley, 13–14.viii.1955 (*Gressitt*); 1 ♂, 1 ♀, I. B., Bokondini, 40 km N. of Baliem Valley, c. 1300 m, 16–23.xi.1961 (*S. & L. Quate*); 1 ♂, 1 ♀, I. B., Kutisme, W. of Swart Valley, 1500 m, 14.xi.1958 (*Gressitt*); 2 ♀, I. B., Star Mts, Sibil Valley, 1245–1250 m, 18.x–8.xi.1961 (*S. & L. Quate*); 1 ♂, I. B., River Tor (mouth), 4 km E. of Hol Maffen, 3.vii.1959 (*Maa*); 1 ♂, 1 ♀, I. B., Kulima, 1400 m, 19–22.ii.1960 (*Maa*); 1 ♂, I. B., Central Mts, Archbold Lake, 760 m, 26.xi–3.xii.1961, by sweeping (*S. Quate*) (all in BPBM, Honolulu); 1 ♂, Papua New Guinea, Laloki, 10.ii.1956; 1 ♀, P. N.G., Lae, 6–7.ii.1966 (*G. Monteith*); 1 ♀, P. N.G., Passam via Wewak, Sepik district, 15.ii.1966 (*Monteith*) (all in UQ, Brisbane); 1 ♂, P. N.G., Wareo, Finsch Haven (*L. Wagner*) (SAM, Adelaide); 1 ♀, P. N.G., Maprik, 17.x.1957 (*J. Smart*); 4 ♂, 5 ♀, P. N.G., Madang District, Finistere Mts., Damanti, 3500 ft (1800 m), 2–11.x.1964 (*M. E. Bacchus*); 19 ♂, 28 ♀, P. N.G., Madang District, Finistere Mts, Moro, c. 5550 ft (1700 m), 30.x–15.xi.1964 (*Bacchus*) (all in BMNH, London); 14 ♂, 26 ♀, P. N.G., Eliptamin Valley, 1200–2530 m, 19.vi–15.ix.1959 (*W. W. Brandt*); 1 ♂, P. N.G., Morobe District, Wau, 1050 m, 5.i.1961 (*G. Monteith*); 1 ♂, P. N.G., Wau, 1100–1200 m, vii.1968 (*N. L. H. Krauss*); 1 ♂, P. N.G., Wau, 1200 m, 1.viii.1961 (*J. H. Sedlacek*); 3 ♀, P. N.G., Wau, 1200 m, 4.viii.1961 (*Sedlacek*); 1 ♂, P. N.G., Wau, 1200 m, 31.viii.1961 (*Sedlacek*); 1 ♀, P. N.G., Wau, 1200 m, 14.ix.1961 (*Sedlacek*); 1 ♂, P. N.G., Wau, 1200 m, 11–15.x.1961 (*Sedlacek*); 1 ♀, P. N.G., Wau, 1200 m, 7.i.1966 (*L. & M. Gressitt*); 1 ♂, P. N.G., Wau, 1200 m, 18.vii.1969 (*Y. Hirashima*); 6 ♂, 4 ♀, P. N.G., Wau, 1200 m, 29–30.ix.1963, m.v. light-trap (*Sedlacek*); 4 ♀, P. N.G., Wau, 1200–1300 m, 25.x.1965, Malaise trap (*Sedlacek*); 2 ♀, P. N.G., Wau, 1250 m, 25.vi.1961 (*Sedlacek*); 2 ♂, 1 ♀, P. N.G., Wau, 1250–1300 m, 20.viii.1961 (*Sedlacek*); 1 ♂, 2 ♀, P. N.G., Wau, 1350 m, 21.iv.1969 (*Sedlacek*); 2 ♂, 2 ♀, P. N.G., Wau, 1400 m, 17.vi.1961, one on grasses (*Sedlacek*); 4 ♂, P. N.G., Wau, 1500 m, 24.ix.1961 (*Sedlacek*); 1 ♀, P. N.G., Wau, 1600–1700 m, 28.xii.1961 (*Sedlacek*); 1 ♀, P. N.G., Wau, 2400 m, 9–12.i.1962 (*Sedlacek and others*); 4 ♂, 3 ♀, P. N.G., Wau, Mt Missim, 950–1300 m, 2.iii.1965 (*J. & M. Sedlacek*); 1 ♂, 2 ♀, P. N.G., Wau, Hospital Ck, 1250–1300 m, 7.iii.1965 (*Sedlacek*); 1 ♀, P. N.G., 24–32 km SE. of Wau, 1500–1900 m, 20.iii.1962 (*Sedlacek*); 2 ♂, 1 ♀, P. N.G., head of Wau Ck, 5000 m, 19.ix.1962 (*H. W. Clissold*); 1 ♂, P. N.G., Mt Missim, 1300 m, 25.iv.1968 (*Gressitt and others*); 2 ♀, P. N.G., Mt Missim, 1600–2000 m, 21–24.ix.1964 (*M. Sedlacek*); 9 ♂, 8 ♀, P. N.G., Lae, Singuawa R., 147° 10′ E, 6° 45′ S, 30 m, 1.iv.1966 (*G. Lippert*); 1 ♂, P. N.G., Lae, 10.iv.1966 (*O. R. Wilkes*); 1 ♂, 3 ♀, P. N.G., Lae, 11.iv.1966 (*P. Shanahan*); 1 ♂, P. N.G., Lae, 20 m, 7.xii.1963 (*Clissold*); 1 ♀, P. N.G., Lae, 30.i.1970 (*Sedlacek*); 1 ♀, P. N.G., Lae, sea level, 26.vii.1955 (*Gressitt*); 1 ♂, 2 ♀, P. N.G., Busu R., E. of Lae, 100 m, 14.ix.1955 (*Gressitt*); 3 ♂, P. N.G., Morobe District, Ulap, 800–1100 m, ix.1968 (*N. L. H. Krauss*); 1 ♂, P. N.G., Wewak, 0–100 m, viii.1968 (*Krauss*); 1 ♀, P. N.G., Iongai, 10 km E. of Mt Albert Edward, 1800–1850 m, 8–10.xi.1965 (*Sedlacek*); 2 ♂, 1 ♀, P. N.G., Madang, Matuka, 0–100 m, 1.x.1968 (*Krauss*); 1 ♂, 1 ♀, P. N.G., Madang, Amele, 0–100 m, 1.x.1968 (*Krauss*); 1 ♂, 2 ♀, P. N.G., Sinofi, 1590 m, 30 km S. of Kaimantu, 1–6.x.1959 (*T. C. Maa*); 2 ♂, 2 ♀, P. N.G., Korop, Upper Jimi Valley, 1300 m, 12.vii.1955 (*Gressitt*); 2 ♂, 1 ♀, P. N.G., Garaina, Saureli, 9–1400 m, 5.i.1968 (*J. & M. Sedlacek*); 1 ♂, P. N.G., Hagen Town, 4° 43′ S, 144° 17′ E, 1650 m, 30.v.1966 (*Gressitt*); 3 ♂, 3 ♀, P. N.G., East Highlands, Aiyura, 1700–1900 m, 6–9.i.1965 (*Sedlacek*); 1 ♂, 2 ♀, P. N.G., West Highlands, Baiyer R., 1150 m, 19.x.1958 (*Gressitt*); 1 ♂, 1 ♀, P. N.G., West Highlands, Korn Farm, 1560 m, 19.x.1958 (*Gressitt*); 1 ♀, P. N.G., Finistere Range, Saidor, Gabumi Village, 1–21.vii.1958 (*Brandt*); 2 ♀, P. N.G., Finistere Range, Saidor, Sibog Village, 27.v–5.vi.1958

(*Brandt*); 3 ♂, P. N.G., Purosa, 20–26 km SE. of Okapa, 1800–2200 m, 28.viii.1964 (*J. & M. Sedlacek*); 2 ♀, P. N.G., Okapa, Okasa, 1400–1650 m, 16.i.1966 (*Sedlacek*); 1 ♂, 1 ♀, P. N.G., 13 km SE. of Okapa, 1650–1870 m, 26.viii.1964 (*J. & M. Sedlacek*); 1 ♂, P. N.G., Maprik, 150 m, 29.xii.1960 (*Maa*); 2 ♂, 1 ♀, P. N.G., Sepik, Maprik area, 160 m, 23.viii.1957 (*D. Elmo Hardy*); 1 ♂, P. N.G., Sepik, Maprik area, 160 m, 28.viii.1957 (*Hardy*); 1 ♂, 1 ♀, P. N.G., Swart Valley, Karubaka, 1300 m, 7.xi.1958 (*Gressitt*); 3 ♂, P. N.G., Swart Valley, Karubaka, 1450 m, 12.xi.1958 (*Gressitt*); 1 ♀, P. N.G., Swart Valley, Karubaka, 1500 m, 20.xi.1958 (*Gressitt*); 1 ♂, P. N.G., Gewak, Salawakat Range, 1530 m, 7.ix.1956 (*E. J. Ford, Jr*); 1 ♀, P. N.G., Wampit V., nr Gurakor Village, 950 m, nr Wau, 7.vii.1957 (*Hardy*); 1 ♀, P. N.G., Wana, Upper Jimi Valley, 1500 m, 11.vii.1955 (*Gressitt*); 1 ♂, P. N.G., Bulolo, 1010 m, 21.viii.1956; 1 ♀, P. N.G., Bulolo R., 1130 m, 17.ix.1959 (*A. B. Mirza*); 1 ♀, P. N.G., Baiyumi R., 16 km N. of Bulolo, 500 m, 25.xi.1961 (*Sedlacek*); 1 ♂, P. N.G., Feramin, 150–120 m, 23–31.v.1959 (*Brandt*); 1 ♀, P. N.G., Huon Peninsula, Finschhafen, 50–150 m, 11.iv.1963 (no collector cited) (all in BPBM, Honolulu); 1 ♀, P. N.G., Kokoda, 1200 ft (350 m), viii.1933 (*L. E. Cheesman*); 2 ♂, 3 ♀, P. N.G., Popondetta, Agricultural Station, 15.viii.1962, feeding on *Desmodium distortum* (*A. Catley*) (all in BMNH, London); 1 ♂, 3 ♀, P. N.G., Moorhead, 18 m, 6.vii.1964 (*H. Clissold*); 1 ♂, 1 ♀, P. N.G., Owen Stanley Range, Goilala, Bome, 1950 m, 8–15.iii.1958 (*W. W. Brandt*); 1 ♀, P. N.G., Bome, 1950 m, 24.ii–7.iii.1958 (*Brandt*); 4 ♀, P. N.G., Goilala, Tororo, 1560 m, 21–24.iii.1958 (*Brandt*); 1 ♀, P. N.G., Goilala, Tapini, 975 m, 16–25.xi.1957 (*Brandt*); 5 ♂, 2 ♀, P. N.G., Aroa Estate, W. of Redscar Bay, 29.ix.1958, on grasses (*J. L. Gressitt*); 1 ♀, P. N.G., Popondetta, 25 m, v.1966 (*G. Lippert*); 1 ♀, P. N.G., Popondetta, 60 m, 1–4.ix.1963 (*J. Sedlacek*); 1 ♀, P. N.G., Popondetta, 24.ix.1963 (*Clissold*); 2 ♀, P. N.G., Popondetta District, Jumbora, 19.ix–15.x.1963 (*P. Shanahan*); 3 ♂, 4 ♀, P. N.G., Laloki, nr Port Moresby, 30.viii–2.ix.1959 (*T. C. Maa*); 1 ♀, P. N.G., Bisianumu, E. of Port Moresby, 500 m, ix.1955 (*Gressitt*); 1 ♂, P. N.G., Western District, Tala, 27·5 m, 13.vii.1964 (*Clissold*); 1 ♀, P. N.G., Subitana, 600 m, 20.v.1961 (*J. L. & M. Gressitt*); 1 ♀, P. N.G., Brown River, 5 m, 23.x.1960 (*J. L. Gressitt*); 4 ♂, 6 ♀, P. N.G., Iongai, 1700–1900 m, 9.xi.1965 (*Sedlacek*); 1 ♂, P. N.G., Mount Kaindi, 2350 m, 7.iv.1966 (*Gressitt*) (all in BPBM, Honolulu); 1 ♂, 1 ♀, P. N.G., Mt Lamington, 1300–1500 ft (400–600 m) (*C. T. McNamara*) (SAM, Adelaide); 1 ♂, 'New Guinea' (*Wallace*) (BMNH, London). ADMIRALTY ISLANDS: 1 ♂, 1 ♀, Manus, Lorengau, 7.vi.1967 (*R. E. & R. M. Blackith*) (BMNH, London); 4 ♂, 3 ♀, Manus, Lorengau, 15–21.vi.1962, one ♂ at m.v. light (*Noona Dan Expedition*) (UZM, Copenhagen). BISMARCK ARCHIPELAGO: 1 ♂, New Britain, Valoka, 4.vii.1962 (*Noona Dan Expedition*) (UZM, Copenhagen); 4 ♂, 3 ♀, New Britain, Gazelle Peninsula, Bainings, St Paul's, 350 m, 4–8.ix.1955 (*J. L. Gressitt*); 1 ♂, New Britain, Gazelle Peninsula, Gaulim, 140 m, 21–27.x.1962 (*J. Sedlacek*); 1 ♀, New Britain, Ti, Nakanai Mt, 28.vii.1956 (*E. J. Ford, Jr*); 1 ♂, New Britain, near Rabaul, ii.1929 (*Pemberton*) (all in BPBM, Honolulu). SOLOMON ISLANDS: 1 ♀, Bougainville, Kihili, nr Buin, 1 m, 31.v.1956 (*J. L. Gressitt*); 1 ♀, Bougainville, Kukugai Village, 150 m, xii.1960 (*W. W. Brandt*) (both in BPBM, Honolulu); 1 ♀, Bougainville, 6.vii.1922 (*E. A. Armytage*); 1 ♂, Guadalcanal, Kookoom (*R. A. Lever*); 1 ♀, Guadalcanal, Lunga, 29.iii.1934 (*Lever*); 1 ♀, Guadalcanal, Lunga, 4.iii.1935, on leaf of *Sida retusa* (*Lever*) (all in BMNH, London).

Gralliclava australiensis sp. n.

(Figs 70, 79, 102, 108)

Length: ♂, 6·7–8·2 mm, mean 7·3 mm (n = 12); ♀, 7·6–8·6 mm, mean 7·9 mm (n = 17).

Similar to *G. horrens*. Ratio of lengths of antennal segments I : II : III : IV about 1·00 : 0·83 : 0·66 : 0·89; length of segment III divided by length of segment II 0·76–0·87, mean 0·85 (n = 31); length of segment I divided by width of head including eyes 1·08–1·32, mean 1·17 (n = 37). Pronotum with postero-lateral spines upcurved, width across tips of spines divided by width of head including eyes 2·41–2·86, mean 2·65 (n = 32). Male paramere (Fig. 79) with apex stout and strongly angled inwards; genital capsule (Fig. 70) with tongue broadly and shallowly produced, with small median emargination. Conjunctiva with distal dorsolateral lobes somewhat shorter than those of *G. horrens* but not as short as those of *G. indica* and its allies. Female second valvula (Fig. 102) and sclerites of gynatrium wall (Fig. 108) differing little from those of *G. horrens*. Colour, sculpture and pubescence as in other species of the genus except that female tergum IX is almost unicolorous stramineous, lacking a median macula. Posterior femur dark red in apical half, with 0–2 stramineous spots anteriorly and posteriorly.

REMARKS. Distinguished from all other species of the genus by the shape of the male paramere and tongue of genital capsule. The unicolorous tergum IX of the female is a constant character and serves to distinguish this sex of the species from its relatives. There are some morphometric differences between populations of this species in Queensland and in the Northern Territory. The principal ones are: ratio of antennal segments I : II : III : IV in Northern Territory about 1·00 : 0·84 : 0·67 : 0·89, in Queensland about 1·00 : 0·81 : 0·65 : 0·89; length of segment I divided by width of head in Northern Territory 1·08–1·28, mean 1·15 (n = 22), in Queensland 1·11–1·32, mean 1·20 (n = 15); width of pronotum divided by width of head in Northern Territory 2·41–2·86, mean 2·68 (n = 18), in Queensland 2·48–2·70, mean 2·60 (n = 14).

DISTRIBUTION. Tropical Australia.

MATERIAL EXAMINED. Holotype ♂, AUSTRALIA: Northern Territory, Darwin, Nightcliff, 2 m, 2.x.1960 (*J. L. Gressitt*) (BPBM, Honolulu).

Paratypes. AUSTRALIA: 3 ♂, 4 ♀, same data as holotype; 2 ♂, 6 ♀, Northern Territory, Darwin, Nights Cliff, 2 m, 2.ix.1960 (*J. L. & M. Gressitt*); 1 ♂, Northern Territory, Holmes Jungle, Palm Creek, 15 km NE. of Darwin, 5 m, 13.iii.1961 (*J. L. & M. Gressitt*); 1 ♀, Northern Territory, Darwin, E. Point, 23.ix.1958 (*J. L. Gressitt*); 3 ♂, 5 ♀, Northern Territory, Black Jungle, near Humpty-doo, 24.ix.1958 (*J. L. Gressitt*) (all in BPBM, Honolulu); 1 ♂, Northern Territory, Port Darwin (no other data); 1 ♀, Northern Territory, Darwin, 19.v.1913 (*G. F. Hill*) (both in BMNH, London); 1 ♀, Northern Territory, Darwin, 19.v.1913, on cucumbers (*G. F. Hill*); 1 ♀, Northern Territory, Darwin, 15.v.1914 (*G. F. Hill*); 2 ♀, Northern Territory, Darwin, Mitchell St, Mrs Eddy's garden, 6.i.1961 (*G. F. Gross*); 1 ♀, Northern Territory, Darwin (*G. F. Hill*); 1 ♂, Northern Territory, Port Darwin (no other data); 1 ♂, Northern Territory, Darwin (*W. K. Hunt*); 1 ♂, Bathurst I., x.1918 (*G. F. Hill*); 3 ♂, Melville I. (*W. D. Dodd*) (all in SAM, Adelaide); 1 ♂, Queensland, Cairns District (*F. P. Dodd*); 1 ♂, Queensland, Kuranda (*F. P. Dodd*) (both in SAM, Adelaide); 1 ♀, Queensland, Mackay, i.1899 (*A. J. Turner*); 1 ♂, Queensland, Townsville, Alligator Creek, 25.iv.1934; 1 ♀, Queensland, Kuranda, 1100 ft (345 m) 21.v–24.vii.1913 (*R. E. Turner*); 1 ♂, 2 ♀, no data but probably from Queensland (all in BMNH, London); 1 ♂, Queensland, Iron Range, Cape York Pen. 11–17.v.1968 (*G. Monteith*); 1 ♂, Queensland, Paluma Dam, 27.xii.1963 (*Monteith*); 1 ♂, Queensland, W. Normanby R., 40 miles W. of Cooktown, 2.i.1964 (*Monteith*); 1 ♀, Queensland, Koah, 14.ix.1959 (*G. Ettershank*); 1 ♀, Queensland, Ayr, 19.viii.1960 (*M. Breen*); 1 ♂, 2 ♀, Queensland, Airstrip, 27 km N. of Coen, 28.vi.1975 (*Monteith*); 1 ♂, 1 ♀, Queensland, Christmas Ck, 15 km W. of Fairview, via Laura, 26–27.vi.1975 (*Monteith*); 1 ♂, Queensland, Shiptons Flat via Helenvale, 20–27.vii.1974, ABRS Site 1, Rainforest, 198 m (*Monteith & D. Cook*); 2 ♀, Queensland, Dulhunty R. Xing, Cape York Pen., 27–28.ix.1974 (*Monteith*); 1 ♀, Queensland, Captain Billy Creek, Cape York Pen., 145° 50′ E, 11° 40′ S, 9–13.vii.1975 (*Monteith*); 1 ♀, Queensland, Dividing Range, 15 km W. of Captain Billy Creek, Cape York Pen., 142° 45′ E, 11° 40′ S, 4–9.vii.1975 (*Monteith*) (all in UQ, Brisbane).

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